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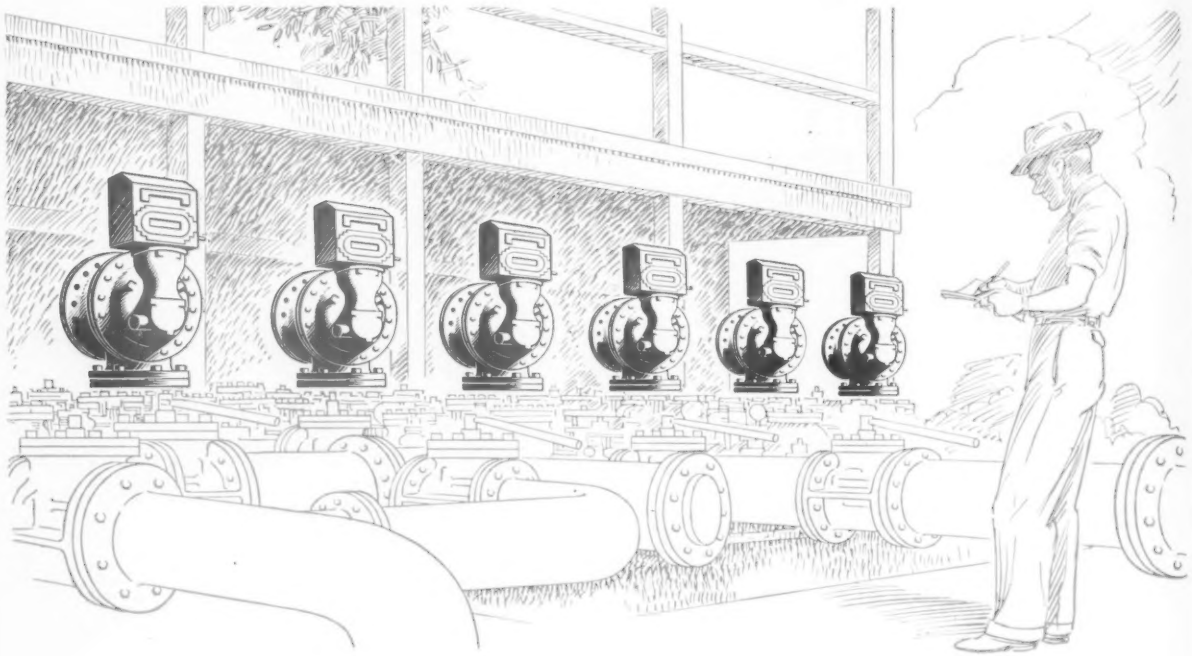

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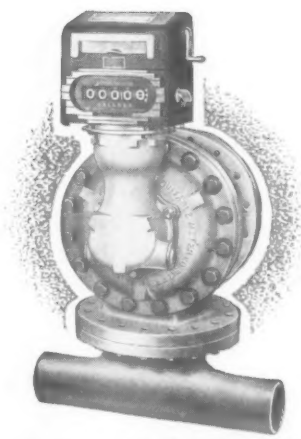

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Table of Contents

NEWS DEVELOPMENTS

British Representatives Will Hew to Party Lines in Revising Treaty 160
DeGolyer Debunks Contention Gas Reserves Are Inadequate 161
Harding Confirms Month-End Closing Date of Directive 59 162
Spread of Strikes Threatened at Midwest, Gulf Coast Refineries 162
Government to Stop Pipe-Line Operations in 30 to 60 Days 164
Low-Cost Operation Made Investment in Big-Inch Lines Profitable 164
Texas Crude Requirements Reduced 165
International News 166
A.I.M.E. Told Secondary Results of Atomic Energy Soon to Be Felt 168
Anglo-Iranian Is World's Largest Single Integrated Operation in Industry 169
Refiners Will Have Short Reprieve from Octane Race 175

Trends 159
This Week 163
Editorial 167
Deaths 168
Natural-Gas News 327
Cycling News 327
Pipe-Line News 329
Refining News 333

PIPE-LINE SECTION

Multicolor Charts and Graphs of Pipe-Line Statistics 177-192
Possibilities of Pipe-Line Research 193
Design of Station Piping for New Construction of Present Installations 195
Pumping Various Products Through Same Pipe-Line System 197
Technique for Determining Installation of Cathodic Units 201
High-Pressure Gasoline Cable-Type Pipe Lines Under English Channel 205
Trussed Creek Crossings for Pipe Lines 211
Construction and Operation of McPherson-Council Bluffs Products Line 212
Special Measures Employed in Dual Gas-Line River Crossing 219
Two-Way Radiotelephone for Pipe-Line Operation 227
Pumping-Station Power Service Is Improved by Capacitors 235
Hydraulic Testing of a Crude-Oil Pipe-Line System 247
Bell-Hole Welding Method Leads in Popularity in Recent Jobs 251
Rotary Pumps in Gathering-Line Service 255
Measures for Improving Packing Practices 261
Practical Suggestions 266-270
High Efficiency Attained in Patrolling Lines with Planes 272
Construction Methods for Interstate's Mississippi-Louisiana Line 275
Products Terminal Designed for Efficient Service 281
Wellhead to Loading Dock Pipe-Line System 287
Aerial Patrol of Lines Has Many Advantages 291
A Short Study of Gathering-Line Salvage 295
Pressure Welding Proves Its Versatility 299
Pipe-Line Coatings Tested for Dielectric Strength 303

ENGINEERING AND OPERATING

Plant Practices 315
Optimum Rate of Production—Part 4 317
Progress in Metals 320
Journalog 323
The Refiner's Notebook 325

EXPLORATION AND DRILLING

Week's Highlights 337
Weekly Well-Completion Record 337
Daily Average Production for Week 338
Reports by Areas Start on Page 338
Summary of August Completions 351

ADDITIONAL FEATURES

Drilling Contractors 352
Market Summary 353
Crude-Oil Prices 353
Personals 354
Calendar of Events 355
Men in Equipment News 356
Classified Advertising 357
Advertisers' Index 360

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Trends

Crude-Oil Production
By States—Page 338

CRUDE-OIL STOCKS 213,721,000 bbl. as of Sept. 8—down 1,448,000 bbl. One year ago 220,623,000 bbl

GASOLINE STOCKS 85,230,000 bbl. as of Sept. 8—up 1,012,000 bbl. One year ago 78,110,000 bbl.

RESIDUAL FUEL-OIL STOCKS 47,871,000 bbl. as of Sept. 8—up 1,064,000 bbl. One year ago 60,722,000 bbl.

GAS OIL AND DISTILLATE STOCKS 42,189,000 bbl. as of Sept. 8—up 1,330,000 bbl. One year ago 41,716,000 bbl.

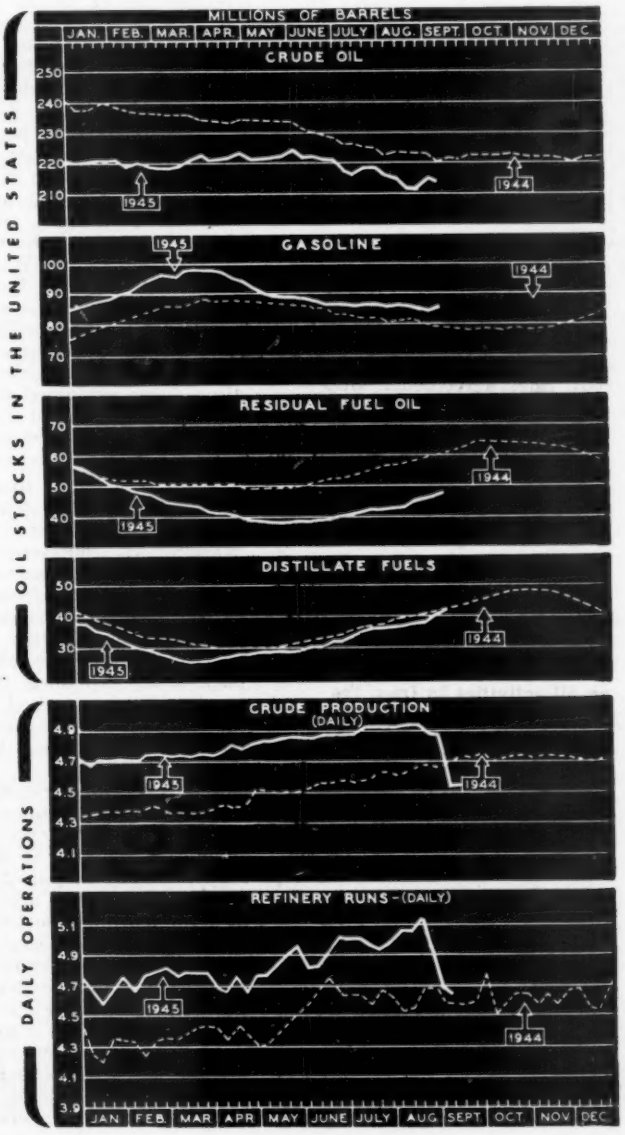
CRUDE-OIL PRODUCTION 4,536,600 bbl. as of Sept 15—up 10,850 bbl. One year ago 4,742,100 bbl.

REFINERY RUNS 4,640,000 bbl. daily week ended Sept. 8—down 45,000 bbl. One year ago 4,634,000 bbl

THE Texas Railroad Commission apparently plans a much more active part in determining from what fields shall be drawn the state's future oil production. Detailed examination of productive capacity of individual fields is being made by commission engineers. Allocation of October production has been deferred, pending completion of the engineering investigation. Before the war, crude-oil purchasers largely influenced withdrawals from individual fields. To some extent, it is assumed, the requirements and facilities of buyers will continue to exert some weight in assignment of field allocations. The commission has indicated, however, that maximum efficient field production rates will receive top consideration in the future.

IF the commission follows through on the policy indicated by its action this week, significant changes must be made in the industry's operations in Texas. First indication of preparation for such changes was given by announcement of a pipeline looping program from West Texas to the Gulf Coast by one of the major producing interests in that part of the state. Much of Texas' potential in excess of recent record production rates is contained in West Texas fields. Room for expansion of present productive acreage is also more abundant in West Texas than in any other area.

REMOTENESS of West Texas fields from the Gulf Coast shipping and refining centers has always made that area the first to feel reaction of curtailed markets. The current situation has proven no exception. When Japan surrendered, West Texas operations were among the first in the country to feel the impact of reduced demand. Now, however, the Railroad Commission indicates that first consideration will be given to physical ability of individual fields to supply nominations of purchasers. This change which results from the war emergency of taking whatever oil was needed from whatever source it was available, regardless of consequences, will accrue eventually to the advantage of West Texas. Additional pipe-line facilities will be required and it will be necessary to accelerate exploration and development drilling. The deeper Silurian, Devonian and Ellenburger prospects, potential producers of sweet crude, will receive greater attention than during the war.



BRITISH REPRESENTATIVES WILL HEW TO PARTY LINES IN REVISING THE ANGLO-U.S. PETROLEUM TREATY, OBSERVERS PREDICT

Ickes declares Britain and U. S. have mutual rights and interests in future oil, as London pact parley starts

by C. O. Willson

This story was cabled to the Journal by its editor, who arrived in London on the eve of the international conference called to work out final agreements with regard to future oil developments as they affect the United States and Great Britain. Willson is now on the last lap of a foreign itinerary which has taken him to the principal oil-producing regions of the Middle East, to Cairo, and to England. He left the States the middle of June. Elsewhere in this issue is another article by Willson on oil activities in Iran, the first of three dealing with operations in that country.

LONDON.—Efforts to arrive at an Anglo-American petroleum pact is recognition of mutual rights and interests of Britain and the United States in present and future world oil developments, Secretary Harold L. Ickes said Monday at a conference attended by a large number of representatives of the British press.

Ickes, as Petroleum Administrator for War, and Ralph K. Davies, deputy administrator, and Charles B. Rayner, petroleum adviser to the State Department, head a delegation of oil men and PAW staff who arrived Saturday for the first conference with the new Labor Government regarding the pact with the hope expressed that final agreements regarding terms can be agreed upon at this time. Ickes explained that the agreement in its present form does not differ materially as to terms from the last announced provisions.

It is anticipated that the British governmental representation which will be largely changed from the last Washington conference will seek some revisions to conform with party policies. Questions from the British press revealed considerable interest in the position of other countries, especially Russia, in relation to the pact. Ickes explained that no country has been consulted in regard to the pact but it is anticipated that later other nations can become members.

In answer to questions, Ickes said that the United States' known reserves at this time represent 14 years' supply in contrast to the 20 years' supply when he joined the cabinet 12 years ago. "We are on our way to becoming an importing country in petroleum," Ickes declared. "When it will occur I do not know."

Relative to future development of the Middle East oil resources which he explained on the basis of the De-Golyer report, Ickes said that the United States as a lender might be interested in the joint construction with the British of a major pipe line serving that area. "We do not want any governmental control of production nor prices. The more competition the better," Ickes emphasized.

In answer to queries as to whether it was possible to carry out a pact without these controls, he explained that the pact does not provide for national control in the United States. The administrator refused to comment on questions dealing with the significance of sterling block arrangements and dollar exchange in relation to future oil dealings between the two countries.

The conference started Tuesday and probably will last a week to 10 days. The Right Honorable R. Shinwell, new minister of fuel and power, will head the United Kingdom delegation and associated with him will be Right Honorable Hugh Dalton, chancellor of the exchequer. The remainder of the Government delegation, including the British oil representation, has not been announced. The London Times, commenting on the meeting, said in part, "The conference may not be wholly without its dangers. It is perhaps unfortunate that the conference should be due at the moment when the new ministers are not yet firmly in the saddle and are preoccupied with many other pressing questions. One result may be that there has been too little preparation."

Accompanying the American delegation as advisers were six oil-industry leaders, all of them members of the National Oil Policy Committee of the Petroleum Industry War Council. They are William R. Boyd, Jr., president of American Petroleum Institute and chairman of the Petroleum Industry War Council; A. Jacobsen, president, Amerada Petroleum Corp. and chairman of the National Oil Policy Committee; George A. Hill, Jr., president, Houston Oil Co.; W. Alton Jones, president, Cities Service Co.; Joseph E. Pogue, vice president, Chase National Bank, and Ralph T. Zook, president, Independent Petroleum Association of America.

DeGolyer Debunks Contention Gas Reserves Are Inadequate

KANSAS CITY. — Debunking the contention that natural gas reserves are likely to play out in a relatively short space of time, E. DeGolyer, nationally known geologist and engineer, asserted here that the "outlook for the discovery of additional gas reserves in substantial quantity is distinctly favorable."

He made this prediction at the opening session of the Federal Power Commission natural gas investigation which opened September 18, after citing the results of his studies which show an estimated present proven natural gas reserve of more than 140 trillion cubic feet.

This estimate of reserves, he said, is calculated on a pressure base of 16.4 psi. and at a temperature of 60° F., except for the Appalachian area, and includes only those fields —some 426—having a reserve in excess of 20 billion cubic feet each.

"For a broad consideration of this important natural resource," DeGolyer said, "it should be noted that if we calculate these same reserves to a pressure of atmosphere or 14.4 psi., allow for small fields not included in the present estimate and allow for a probable extension of discovered fields not yet fully explored, we are justified in considering our present gas reserves to be something of the order of magnitude of 200 trillion cubic feet."

He pointed out that it is important to note that within the last decade and with increasingly deeper exploration for oil the proportion of gas found to oil found has increased substantially.

Outlook for Increased Activity

"In my opinion," DeGolyer stated, "outlook in the United States is for activity on an increasing scale in exploration for oil. I believe that the result of such effort is likely to be the discovery of substantial reserves of natural gas . . . It is fairly well established by recent experience that there is greater likelihood of the mineral hydrocarbons occurring in the gaseous phase than of their occurring in the liquid phase under the relatively high pressures and high temperatures which prevail at great depth. We know that exploration to increasingly greater depths is and must be a marked characteristic of our continued search for oil."

It is on the basis of these circumstances that he contends that the outlook for discovery of additional gas reserves in substantial quantity is most favorable.

Representatives of states and cities, labor unions, railroads, oil and gas industries and kindred fields were here for what promised to be a 2 to 3-week long session.

Calvin Dold, executive assistant to the chairman of the FPC, said the hearing would seek to bring out the answers to two basic questions. They are:

1. What restrictions, if any, should be placed on the exportation of gas out of a state which has no other fuel?

2. What restrictions, if any, should be placed on purposes for which gas now is used?

Among the early arrivals for the session were George H. Smith, New York, assistant managing director of the American Gas Association; Edward Buddrus, New York, chairman of the natural gas industry committee; Tom J. McGrath, Washington, of the Railway Labor Executive Association; Amos M. Mathews, Chicago, Association of American Railroads; Welly K. Hopkins, Washington, United Mine Workers; James W. Haley, Washington, National Coal Association; Charles I. Francis, special counsel for Texas; Fred W. Aley, representing the City of Wichita, and Alfred G. Goldberg, Milwaukee, representing the AFL.

Kansas City Mayor Testifies

Mayor John B. Gage of Kansas City was the first witness to appear before FPC representatives. He advocated regulations preventing movement of natural gas into areas containing abundant coal and other fuel supplies. He urged FPC to seek authority over distribution of natural gas and expressed hope that it would be given jurisdiction over end use. He proposed that authority over conservation remain with the states in which gas is produced.

Gov. Andrew Schoeppel of Kansas, chairman of the Interstate Oil Compact Commission, fostered retention of conservation authority in hands of the states. He cited accomplishments of the Interstate Oil Compact in promoting conservation and said that states have demonstrated willingness and ability to perform this duty. He scored proposals to "straight-jacket" the nation with an over-all conservation policy administered by central authority which would not be applicable to the widely varied conditions in different sections of the country.

Eastern Retail Price Ceilings Cut by OPA

WASHINGTON. — Previously announced general price ceiling reductions on gasoline and fuel oils in the eastern seaboard area became effective at retail establishments September 17.

Reductions in refinery and wholesale (including tank-wagon) ceilings on these products went into effect September 1, 1945.

The reduction in retail gasoline ceilings was 1.2 cents a gallon throughout the 17 states and the District of Columbia comprising the eastern seaboard area with the following exception: In Florida east of the Apalachicola River, Georgia, most of West Virginia, western Pennsylvania and the Buffalo, N. Y., area, the reduction was 6/10 of a cent a gallon.

Retail ceilings for kerosene, prime white distillate, No. 1 fuel oil, No. 2 fuel oil and range oil were reduced 1½ cents a gallon throughout the eastern seaboard area with the following exceptions: In Metropolitan Boston and Rhode Island the reduction was 1.4 cents a gallon; while in Florida east of the Apalachicola River, Georgia, most of West Virginia, western Pennsylvania, and the Buffalo, N. Y., area, the reduction was 1 cent a gallon.

Florida Exploration Campaign Expands

Southern Florida will be watched more closely as a result of the recent announcement that Gulf Oil Corp. had made a deal to acquire an interest in part of the Blanchard concession and would drill several exploratory tests. Exploration and lease option rights on this concession, originally consisting of some 7,000,000 acres of state lands around the southern tip of Florida, were granted to Wm. G. Blanchard on October 4, 1941.

The first Gulf test is reported to be planned for Cupon Bight, near the city of Key West, a second one is likely to be in the northern reaches of the Bay of Florida, with possibly others to follow at various points throughout the concession.

M. L. Benedum et al have an interest in the northern part of this concession, and are drilling below 6,200 ft. in a test in Barnes Sound off the southeast corner of Dade County. Wm. G. Blanchard et al 1 Everglades, 40 miles west of Miami and 50 miles southeast of the Sunniland field, has been standing idle at 10,284 ft., but operator may try to drill another 800 ft. to explore for the Sunniland pay.

Spread of Strikes Threatened at Midwest, Gulf Coast Refineries

STRIKES this week forced suspension of operations at several refineries in the Chicago, Detroit and Toledo areas. Similar action was imminent at several Gulf Coast refineries. Thus, the labor outlook in the petroleum industry assumed top rank in the nation's conversion troubles and became the most bothersome operating problem confronting every unionized refinery in the Middle West and Gulf Coast.

Disputes which caused strikes and threatened others have a common foundation. CIO refinery workers are demanding 52 hours of pay for 40 hours of work. Oil companies have offered increase of 15 per cent in the base wage rate, which CIO unions have rejected as unsatisfactory. The demand of 52 hours of pay for 40 hours of work represents an increase in base wages of 30 per cent.

The wave of strikes started September 17 when 500 workers walked out of Socony-Vacuum Oil Co., Inc.'s East Chicago, Ind., refinery. The plant has crude-oil capacity of 25,000 bbl. daily. Socony-Vacuum's refinery at Trenton, Mich., near Detroit, was struck by 400 employes.

Union leaders asserted that all refineries in the Chicago area will be closed ultimately, throwing approximately 300,000 bbl. of daily refining capacity into idleness.

Four hundred employes walked out at Pure Oil Co.'s refinery in Toledo and union officials asserted that all refineries in the vicinity would be idle by end of this week. However, there is at least one plant in the Toledo district known to be free of CIO domination.

CIO union workers at refineries of The Texas Co. and Gulf Oil Corp. in the Gulf Coast area have voted to go on strike. Votes were cast on the strike issue at seven other Gulf Coast plants during the week with union leaders confident that the decision would be in favor of a walk out unless wage demands are met.

Other refineries in the Chicago area which union officials declare will be closed by the wage dispute are those of Shell Oil Co., Inc.; Sinclair Refining Co., and Standard Oil Co. (Indiana). The latter company has no contract with the CIO union but its operations would be reached through a strike by Stanolind Pipe Line Co. workers delivering crude to the 132,000-bbl. refinery.

Harding Confirms Month-End Closing Date of Directive 59

NEW YORK.—The promptness with which Petroleum Administration for War District 1 operations are being liquidated, and the proof that no holdover curbs are contemplated, will be evidenced in the last regulative order concerning Directive 59, expected before the week ends. With industry operations now on the third and final quarter, PAW will announce that any assignment not picked up by October 10 will revert to the assignor but will be charged to the assignee as far as the latter's participation in the Directive 59 pool is concerned.

Since The Oil and Gas Journal disclosed last week that Directive 59 would have no further meaning after October 1, Charles Harding, District 1 director, has confirmed that September 30 is the closeout date. At the same time the agency is placing responsibility squarely upon industry itself as to how long PAW district offices will remain open. Company reports must be quickly and accurately filed, PAW will notify industry in its September 20 order. Any delay by the companies in their final report filings will simply delay the date at which industry will be completely on its own. By October 20 all filings of composite statements are expected to be in and any time thereafter PAW may formally cease to exist in the 17 eastern states and the District of Columbia.

All assignees will be required to notify their assignors by September 24 of their intention to accept or forego current assignments. Those who fail to lift assignments already made under Directive 59 will be charged for the amounts assigned. This means that prompt action will be needed on the part of many suppliers or they will be paying for products they don't receive. This charge-off will be a factor in the final adjustment of inventories.

Reassignees also must notify reassignors of their plan to lift reassignments not later than 3 days after issuance. All reassignments themselves must be picked up by September 30 or they will be forfeited.

Allowance will be made for any rate changes that may become effective during the period of the closing dates, such as tanker tariff reductions by WSA or OPA.

PAW's District 1 offices are now operating on less than half of the wartime staff, and the personnel will be trimmed to one-quarter normal strength by October. By the end of October the district expects to have only half a dozen employes left on the job, winding up bookkeeping tasks.

District 2, PAW, Winds Up Its Affairs for Liquidation

CHICAGO.—"My hat is off to you and all who have been associated with you as chairman of District 2 for a job well done," wrote Frank Phillips, chairman of Phillips Petroleum Co., to O. D. Donnell, general chairman of the district, on the occasion of a meeting here last week to wind up the business of this Petroleum Administration for War agency. Under Phillips' guidance 4 years ago was set up the framework for an organization which solved a succession of oil-industry problems created by the war in the mid western territory.

At the joint meeting of all District 2 committees Donnell read a letter from Ralph K. Davies, deputy petroleum administrator, expressing "genuine pride in the record of accomplishment established by the Government-industry petroleum partnership."

The general committee voted its appreciation of the tasks performed by Harold L. Ickes, petroleum administrator; Davies; E. J. Bullock, district director in charge, and Alton C. Sailstad, secretary of the general committee. W. W. Vandeveer, former director in charge, paid a warm tribute to the service given by Donnell and other committee leaders.

Chairmen of functional committees who submitted reports and expressed gratitude for the spirit of cooperation manifested by the oil industry included Paul G. Blazer, refining; Burt R. Bay, natural gas and natural gasoline; B. L. Majewski, distribution and marketing; D. D Irwin, for A. W. Peake, supply and transportation; Andrew Ritchie, for K. S. Adams, production.

THIS WEEK

REVIVAL—Touring services of major refiners expanding rapidly to meet demands of road-hungry motorists. . . . Inquiries double since end of gasoline rationing. . . . Temporary shortage of road maps. . . . Oil industry distributed 50,000,000 annually before war. . . . ¶Standard of New Jersey predicts active demand for oil products in former enemy countries. . . . Vitally needed in rehabilitation of war-ravaged regions. . . . ¶Goodyear president says tire production will "soar to record heights." . . . Predicts early end of rationing. . . . ¶ODT removes all restrictions on group travel October 1. . . . A.P.I. and other oil and gas organizations naming definite dates for conventions. . . .

IDEAS—New insecticidal fog applicator promises to destroy flies, mosquitos, etc., without injuring clothing, food, furnishings. . . . Light-oil solution atomized into infinitesimal particles. . . . ¶Storage of foreign crude in this country's depleted fields characterized as impractical by Pennsylvania Grade research director. . . . Says nations wouldn't stand for it anyway. . . . ¶Howard Cowden, leader in cooperative movement, urges United Nations take jurisdiction of oil production in Middle East and all other areas outside Big Five countries. . . . International board would regulate output. . . .

TILTS—Packard president condemns peacetime government control of automobile prices. . . . "Nobody's going to price himself out of the automobile field." . . . Competition healthy. . . . ¶Louisiana attorney general rules municipality has right to build natural-gas distribution system if it doesn't have to borrow money. . . . ¶Michigan will fight effort of Panhandle Eastern to obtain FPC's permission to export 1,300,000,000 cu. ft. of gas annually to Canada. . . . Company provided state with only 37,000,000,000 cu. ft. last year. . . . "Could have used 100,000,000,000." . . . ¶Oil companies must pay Connecticut $885,537 withheld 10 years on theory could keep it as 1 per cent deduction from gasoline tax they collected for state. . . . Amounts range from $2 to $186,152. . . . ¶Britain preparing protest against Russia's demand for half of Austria's petroleum. . . . Expresses "concern and surprise." . . .

DISCORD—Truman reorganizing labor department to handle mounting dissension. . . . ¶Many oil workers in Illinois, Indiana, Michigan quit jobs. . . . Employes Gulf Coast refineries taking strike vote. . . . All demanding 40-hour week with no pay reduction. . . . ¶All Ford production halted by "irresponsible labor groups." . . . CIO workers threaten walkout at General Motors. Chrysler plants if demand for 30 per cent wage increase is refused. . . . Have $4,000,000 reserve to back exactions. . . . ¶Detroit situation considered "ominous." . . .

LAUDATORY—"My hat's off to you," says Frank Phillip to Chairman Donnell as latter winds up business of District 2. . . . "Job well done." . . . Phillips supervised district's original setup. . . . ¶Aviation gasoline advisory committee wins PAW encomium. . . . "No more outstanding example of conspicuous service." . . .

PIPE LINES—Two pipe-line construction contracts—one for $8,000,000, other for $6,000,000—give this branch of the industry promising postwar start. . . . ¶Government planning to sell or lease Big-Inch and Little-Inch lines. . . . Operation of both to end about October 15. . . . ¶Legislative amendments proposed to allow RFC more time to deal with whole problem of ultimate disposition of war-emergency lines. . . . No definite policy established yet. . . .

PRODUCTION—Nation's daily crude output 4,536,800 bbl. up 10,850. . . . Kansas, up 18,400 bbl., contributed biggest increase. . . .

Acme Photo

This refinery near Yokohama is a mass of ruins after incendiary-bomb attack by U. S. bombers. Note ends of oil drums, which have been burst open in the intense heat. Practically all the structures have been leveled

XUM

Government to Stop Pipe-Line Operations in 30 to 60 Days

by Henry D. Ralph

WASHINGTON.—Operation of all Government-owned oil pipe lines will be discontinued within the next 30 to 60 days and they will be offered for sale or lease, it has been announced by Renconstruction Finance Corp.

Purchases of crude and products for the two big-inch War Emergency pipe lines will stop when September commitments are completed, and as deliveries are made the lines will be filled with water and a preservative and will be listed as surplus property.

The other three lines to be discontinued are the Trans-Florida, the Richmond extension of the Plantation, and the Southwest Emergency line from Corpus Christi to Houston. The sixth Government-owned line, between Fostoria and Akron, Ohio, has already been leased for private operation. Dimensions and locations of these lines appear on the Pipe-Line News pages.

The announcement of RFC was as follows:

During the operation of these five lines it is estimated that shipments through them will have totaled about 483,000,000 bbl., consisting of approximately 327,000,000 bbl. of crude and 156,000,000 bbl. of petroleum products, principally gasoline and heating oil.

The investment in the big-inch is approximately $78,535,000 and in the little big-inch about $67,300,000.

The investment in the Florida Emergency Pipeline is $4,210,000. Through it was shipped 19,400,000 bbl. at a total operating cost of $0.0808 per barrel.

The Greensboro and Richmond extension of the Plantation pipe line cost $3,400,000 and delivered 21,900,000 bbl. at an operating cost of $0.0480 per barrel.

The investment in the Southwest Emergency Pipeline is $6,130,000. It delivered 50,775,000 bbl. at an operating cost of $0.0234 per barrel.

The pipe lines were constructed by Reconstruction Finance Corp. (Defense Plant Corp.) to meet the critical emergency created by the loss of tank ship operations as the result of enemy submarine actions and the necessity of utilizing all available tankers to move American products to war theaters.

The big-inch and little big-inch lines have not been operated as common carriers but wholly for the account of the federal Government. The other RFC lines served as common carriers.

The pipe lines were only part of the over-all program to equalize the cost of transportation of all petroleum and petroleum products moved to the eastern section of the United States so that East Coast refiners and marketers obtained crude oil and products at the same delivered cost regardless of the method of transportation used.

The law under which the pipe lines were built requires that they be offered for sale when no longer needed for purposes of national defense. However, a later enactment, the surplus-property law, imposes various restrictions on the disposal of such properties, including the stipulation that the sale shall not promote monopoly. Under this law any sale of properties so large would have to be approved by the attorney general and by Congress before becoming final.

It is probable that one or the other of these laws may be amended by Congress, or perhaps some special legislation enacted. The entire subject is due for an airing at hearings to be held shortly by the Senate petroleum-resources committee.

The capacity of the two WEP lines and the economic implications of their continued operation make it unlikely that offers to purchase will be made by either major oil companies or groups of independents, but RFC is ready to consider any sort of offer. Suggestions have been made that the lines might economically be converted to carry natural gas, but no definite proposal has been made.

Low-Cost Operation Made Investment In Big-Inch Lines Profitable

by Paul Reed

ANALYSIS of costs of the big-inch and little big-inch systems of War Emergency Pipelines, Inc., indicates that the original investment was paid back before the end of the war. This is determined by deducting actual costs directly from increments credited to the system which are comparable to existing pipe-line rates and by disregarding such credits and charges as would not normally enter ordinary routine accounts of pipe lines generally.

The investment in the lines, according to Reconstruction Finance Corp., is as follows:

24-in. line	$ 78,535,000
20-in. line	67,300,000
Total	$145,835,000

The accumulated revenue from the transportation of crude oil and products from Texas to the East Coast for both lines totals more than $147,000,000, according to deductions made from RFC data. Shipments entirely to the East Coast up to August 31, 1945, were, approximately: Crude oil, 210,000,000 bbl.; products, 107,125,000 bbl. Total operating, maintenance, and administration costs have been: Crude system $16,482,986; products system, $10,826,164, at a recent accounting date. The average operation cost per barrel through June 30, 1945, was: Crude system, $0.06851; products system, $0.11105. An average net profit may be estimated by deducting these costs from the increments which represent the gross per barrel income credited to the WEP system. Such increments are: Crude oil, 60 cents per barrel; products, 43 cents per barrel. Cumulative operating revenue August 31, 1945, for the 24-in. line was more than $113,000,000; for the 20-in. line, approximately $34,000,000; total, $147,000,000.

Far from being a financial white elephant WEP facilities have been highly profitable, not only repaying the entire investment before the end of the war but continuing to make profits of approximately $8,000,000 per month or $260,000 daily from increment amounts comparable to tariffs approved by the Interstate Commerce Commission for similar service by other lines. Since the WEP accounts are not kept according to conventional pipe-line procedures because of the emergency nature of the undertaking, interpretations should be made with that in mind. According to certain analyses WEP is regarded as having paid back its entire investment as early as April 1945.

Actually, of course, the total in-

crements added to the per barrel price of shipments have been 80 cents for crude oil and 65 cents for products.

On September 1, 1945, these increments or rates were reduced approximately 30 per cent for the period in which preparations were being made to discontinue operating WEP according to war schedules. From the wartime increments deductions have been made to refund buyers of oil and products amounting to 20 cents per barrel for crude oil and 22 cents per barrel for products. These deductions have been made ever since WEP operation started. The deduction for refund to buyers of crude oil was intended to put transportation expense on a normal-tanker basis of 60 cents per barrel including 17 cents for pipeline gathering and trunk transportation and 43 cents for tanker rates. Sixty cents represents average prewar rates per barrel of moving oil from well to tanker and points of delivery north of Cape Hatteras. Furthermore, in examining the average shipping cost in RFC accounts for WEP through June 30, 1945, amounting to $0.28811 per barrel of crude oil it should be observed that $0.21960 per barrel of this is for gathering and transportation costs for bringing crude to feed WEP at Longview. The average gathering charge for products was only $0.00133 per barrel. The amounts paid for realty taxes at certain points are not included in cost figures and are not sufficient to materially affect conclusions regarding the profitable nature of WEP operations. For a government operation of this kind charges are not made for interest. If such charges had been made the systems would still have paid out.

In determining the profits of WEP as a government project it seems proper to subtract actual out-of-pocket costs from increments per barrel credited to the line which are consistent with established commercial pipe-line rates for similar service. WEP was built not for competitive purposes but as a war measure. Consequently, for convenience, charges for transporting oil to the line were made against WEP accounts which should not obscure the true earning power of the line under the conditions with which it operated. At the same time, it is apparent that the economic situation of such a project built in peacetime would have been less favorable in many respects.

Without the management and technical skill which the major oil companies furnished the government, it would not have been possible for the government to have the transportation services of WEP which were vital in waging the war.

Moreover, the allocation of more than 500,000 bbl. daily through such a system made possible a rapid payout at current earnings. In peace it is doubtful whether arrangements could have been made for massing shipments in this way.

Now that WEP has paid out the lines could be sold or leased on a basis estimated for meeting competitive tanker costs ranging from 12 to 20 cents per barrel for points north of Cape Hatteras from the Gulf Coast.

If the 24-in. line were operated at half capacity, dropping from 300,000 bbl. to 150,000 bbl. daily operating costs could drop from present level of $0.068 to approximately $0.046 because of reduction of power needed when declining from a total pressure for the line at full capacity of approximately 15,000 psi. to 4,500 psi. for half capacity. This might suggest that the Post Office Department might use it for delivering a 42-gal. barrel of oil from Longview to New York for a 5-cent stamp. But the solution of the WEP problem is far from being so simple. For operating the 24-in. line under private ownership it would be necessary to add a per barrel amount for other charges as taxes, interest, depreciation, and amortization of approximately 6 cents when operating at full capacity and 12 cents for half capacity.

The disposition of WEP for peace conditions is one of the serious problems facing the country because the lines were built to meet abnormal conditions.

Legislation on Submerged Oil Rights Being Pressed

WASHINGTON. — Legislation to outlaw any claims of the federal Government to lands and oil rights submerged under coastal or inland waters is being pressed for action in Congress.

The House rules committee last week granted a special rule for early consideration of the Sumners resolution (H.J. Res. 225) which has been favorably reported by the House judiciary committee, and the resolution is expected to come up this week. This resolution, a rewrite of about a dozen of similar intent on which hearings were held last spring, simply affirms that title to submerged lands lies with the separate states except for specific sales and grants made by the states.

Enactment of the resolution would nullify the suit filed last spring by the Department of Justice to assert federal title to oil-producing lands under the Pacific Ocean off Long Beach, Calif., and would put an end to the claim advanced by various federal officials during the past few years that submerged lands belong to the federal Government rather than to the states. Supporters of the legislation insist that until recently there has never been any question that state sovereignty extends to submerged lands under rivers and harbors and under the coasts up to the international limit. While oil interests are chiefly affected at present the controversy involves title to fishing rights, reclaimed land, piers, and other structures.

A similar resolution is due for early consideration by the Senate judiciary committee.

Proposed Sale of Margay Approved by Directors

Directors of Margay Oil Corp. at a meeting in Tulsa last week adopted a resolution looking to sale of Margay's interests to Standard Oil Co. of Ohio. The consideration involved in the prospective transaction is not officially reported. Margay has holdings in Oklahoma, Texas, and Kansas, with a daily crude-oil production of 2,400 bbl.

Texas Crude Requirements Reduced

WASHINGTON. — The Petroleum Administration for War last week announced that its estimates of petroleum demands for October indicated that a daily rate of 2,034,000 bbl. of all petroleum liquids would be required from Texas next month.

Of this quantity, it was expected that 1,868,000 bbl. daily would be crude oil. This crude-oil figure represents a reduction of 110,000 bbl. daily from that quantity of crude oil which calculations indicated would be required for September.

In explaining the reason for this reduction, the PAW pointed out that its present estimates of the crude-oil demand on Texas through the first quarter of 1946 would require an average production from that state of 1,978,000 bbl. daily for the period. Because of additional crude oil being made available during October through disposition of the line fill and stocks in connection with closing out the War Emergency Pipeline, the indicated production rate required for October has been reduced to take into account this temporary operation.

XUM

INTERNATIONAL

Grave Dangers Seen in "World Oil Cartel"

NEW YORK.—The evolving international petroleum cooperative is a device which may be seized on by Russia for the extension and consolidation of her power over important oil areas of the world, in the opinion of many industry leaders here.

The industry closely watched the London conference of the International Cooperative Alliance, held during the week of September 10, one of the aims of which was to create an international petroleum cooperative which is generally described as a "world oil cartel."

Two days after the London parley opened, Russia proposed independent seating and recognition for the Baltic republics of Latvia, Estonia and Lithuania. The Russian suggestion caused a sensation in the cooperative conference, claiming to represent 75,000,000 persons in 35 countries.

Charles E. Egan, New York Times correspondent in London, summed up opinion in the dispatch in which he said that "delegates speculated upon the possibility that Russia was using the International Cooperative Alliance as a testing ground for diplomatic moves that she expected to make in the United Nations session later on."

Howard A. Cowden, president and general manager of Consumers Cooperative Association, Kansas City, a delegate to the London parley, has been voluble in his declarations for the need of the cooperative world oil cartel. In London he said:

"It is not safe to leave the most important commodity in war and peace, the most explosive commodity in international commerce, in the hands of private-profit international cartels."

Another leader in the cooperative world oil cartel, also a delegate at the London conference, is Murray D. Lincoln, president of the Cooperative League of the United States of America. Lincoln said in London:

"Before the war American petroleum cooperatives arranged a number of successful deals for the sale of gasoline and other oil products to British cooperatives in exchange for tea. International cooperative trade in food, raw materials and manufactured products will establish standards of performance which may alter the entire complexion of international trade."

The Russian action links with the current Moscow demand that the Soviet Union be granted half of total Austrian oil production. Moscow has reached an understanding to this effect with the Austrian Renner Government, but without consultation with the three other Allied nations that constitute the Control Council of Austria.

British and American industry feeling is aroused at the high-handed Russian tactics. The British Government is ready to send a strong note of protest direct to Premier Stalin. Such Russian action in draining the oil production of Austria would seriously disturb the whole petroleum economy of Europe and especially of Austria which is one of the few countries in Europe with self-supporting oil. Production has soared in Austria under Nazi exploitation 50 times over 1937 levels.

The Russian move came just before the Anglo-American petroleum conference in London and may affect the course of those discussions aimed at a United States-British treaty to replace the one killed in the Senate this year.

There is much evidence that cooperative leaders may attempt to "muscle in" on the treaty negotiations. The international cooperative petroleum project is already highly politically tinged. Cowden declared during the London session that an international oil authority might be needed "for orderly oil exploration and development, equitable distribution and the avoidance of waste of petroleum resources by fitting production and the market together."

Cowden said that intercompany rivalries could be liquidated by such an international authority and threats to peace would be obviated if the United Nations would take control of the Middle East oil production as well as all other sources of supply outside the territories of the Big Five nations.

Within a year an export total of 200,000,000 gal. of gasoline will be handled through international cooperative trade deals, Cowden predicted.

South Mediterranean Is Withdrawing From Egypt

Arrangements are being completed covering the purchase of the assets of South Mediterranean Oil Co., Ltd. (Standard Oil Co. of California and The Texas Co.) by the Standard Oil Co. of Egypt, Socony-Vacuum Oil Co., Inc., and Anglo-Egyptian Oilfields, Ltd. (Shell). The South Mediterranean company has been prospecting in Egypt since 1938 and the three purchasing companies will absorb the company's properties in their Egyptian operations. The Anglo-Egyptian company is a producer, refiner, and supplier in Egypt and the other two buying companies have extensive exploration operations in Egypt. The Socony-Vacuum company is also a distributor in Egypt.

The South Mediterranean company last May announced that it would withdraw from Egypt. The decision followed the completion of a dry hole about 25 miles northwest of Cairo. The test, known as the 1 Khatatba, was drilled to a depth of 7,000 ft. The company over a period of several years carried on extensive exploration work in Egypt using field geology and geophysical methods. It has approximately 240 exploratory permits in Egypt aggregating more than 5 million acres. In addition to a large drilling rig the company has portable units for structural drilling. A geological laboratory is maintained in Cairo where the main offices are located. The three purchasing companies will use the drilling and other equipment in their own exploratory and development operations.

The American management and staff of the South Mediterranean company have been or will be transferred to operations of affiliated companies.

Creole's Production Declines Slightly

Creole Petroleum Corp., largest crude-oil producer in the world, reports its Venezuelan production during August 1945 was 501,413 bbl daily, of which two-thirds, or 337,042 bbl., came from the Lake Maracaibo area, and the remaining one-third, or 614,371 bbl. from eastern Venezuela, including Cumarebo. In round numbers, this represented an increase of 80,000 bbl. daily over August 1944, divided 50,000 bbl. increase from Lake Maracaibo area, and 30,000 bbl. from eastern Venezuela. Creole's July production averaged 504,163 bbl. daily.

August completions totaled 28, including 25 producers and 3 dry holes of which 2 were wildcats. No successful wildcats were reported for the month. Producers averaged 646 bbl. initial production. Total footage of all completed wells, 143,409 ft., or average depth of 5,122 ft. The Jusepin field led the completion list with 11 producers and 1 dry hole, followed by B. C. F. with 7 producers, Mulata with 6 producers and San Joaquin with 1 producer.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Fair Policy Needed

DEFICIENCIES of the national labor policy are being felt for the first time in their complete weakness. The alarming spread of strikes has hit the oil industry with full impact. Unless the trend is checked the loss in productive work will reach staggering figures.

Conversion to peacetime operations is inevitably accompanied by reduced requirements on industry. This applies to all phases of activity, from production of the raw material to the end product. Conditions prevent the oil industry from maintaining the 48 to 52-hour week which was necessary during the war emergency. Now veterans are returning from military service, previously unavailable manpower is being released by suspended war industries. These men seek permanent positions in peacetime industry. Postwar objectives of record national income cannot be approached without full employment.

Industry has been notified that unpalatable legislation, possibly direct government interference, will result if wide unemployment returns. Private business is threatened from one side with extinction if it fails in providing jobs. From the other, labor's demands make full employment virtually impossible.

Most of the large oil companies have increased base wages by 15 per cent. Thus, the decline in take-home pay has been substantially modified in the process of converting to a normal 40-hour week. Many of the companies have received gratifying commendation from employes. Unfortunately, this gracious acceptance of changed conditions does not include a majority of the CIO unionized refineries.

This week's strikes at scattered refinery centers threatens to spread. Work stoppage at other plants in the Chicago and Gulf Coast areas is imminent. Union negotiators demanded 52 hours of pay for 40 hours of work. The company's offer of 15 per cent increase in base pay was rejected.

Unionized labor is obviously launched on a program of getting everything possible immediately. There seems no disposition to seek by stages the ultimate desired increase of 25 to 30 per cent. In this policy it is conceded that strong support has been received from high government officials. The Office of Economic Stabilization, according to reports, is according support to union leaders, encouraging them to demand the entire adjustment in one bite. Industry expects to pay higher wages. Sincerity of this intent is a matter of record, certified by voluntary advances, already made by most oil companies.

Previously, this page called attention to the grave problems ahead for management and labor. The suggestion then was for careful and intelligent consideration by all concerned. Work stoppages are injurious to all. Idle plants meet no pay rolls.

Oil companies have done their part by making voluntary adjustments in basic wage scales. When conditions of consumption justify, other increases will be in order and probably will be extended willingly by progressive management. Until then, however, labor has the responsibility of accepting reasonable advances. Industry cannot remain vigorous without profit. Labor should be very careful to avoid demands which destroy ability of industry to bargain.

XUM

A.I.M.E. Told Secondary Results Of Atomic Energy Soon to Be Felt

by Charles J. Deegan

ALTHOUGH commercial harnessing of atomic energy may be many years off, the secondary results, or byproducts of the atomic bomb will be felt within a very short time in some extent in every nook and cranny of every existing industry. This was one of the thought-provoking observations brought to the Mid-Continent section of the A.I.M.E. at its 1945-46 opening meeting, during a talk on atomic energy by Rovert E. Fearon, consultant on nuclear physics for Wells Surveys, Inc., Tulsa.

Stressing that while the excitement and interest at the moment were naturally centered on the long range potentialities of the energy released, the speaker pointed out that there was an extremely important factor of immediate application involved. That factor was the new ability to produce various forms of synthetic radio-active compounds at a reduction in cost to probably one-thousandth that of former methods.

He pointed out that most sources of radio activity presently available for industrial applications gave mixtures of various types of such activity. Some components of these present-day forms are ideal for certain applications, but other components have no particular use and serve only to cancel part of the effectiveness of the useful portions.

With the new knowledge of Plutonium, Uraniums 235 and 238, and their fission, it should be possible to produce very cheaply, via neutron bombardment, a synthetic radio-active compound of specified properties for a definite job. A manufacturer who is now using X-rays or radiography for examination of his product, will then be able to purchase, at a far lower cost, a specific synthetic radio-active element, with properties adapted to his special problems, and one which will give much more exact results.

Application of these new synthetic radio-active tools in the field of metals has at least three important sectors open, according to Fearon. The first, and possibly the most fundamental, will be in studies of the basic principles of alloys. The second will be in the manufacture and shaping of equipment. The third will be in studies of corrosion and other types of failure of the finished product while in use. There will probably be many other applications, but at the moment, these three look promising.

Regarding the first, studies of the basic principles of alloys, other authorities point out that at present a substantial part of our knowledge on this subject is empirical, i.e., derived from trial and error. Most of it is of course scientific knowledge of fundamental principles, and the electron microscope is aiding greatly in this field. However, when new and cheap synthetic radio-active tools are available, great advances should be possible.

These same authorities point out that X-ray and radiography are already in use as inspection tools by many manufacturers, revealing hidden flaws in finished products that are undetectable by any other inspection method. A new synthetic radio-active tool that cheapened the cost of this process and gave better results would immediately widen the field for application of this type of inspection. The result should be improved products.

Huge Sums for Research

In the third, corrosion effects, these same authorities point out, that large sums of money are now being spent on research. No subject appears to be of greater interest to engineers and operating men than corrosion problems. In some quarters there are hopes that new synthetic radio-active tools may make possible giant strides in solving corrosion problems.

Speaking of possible applications of new synthetic radio-active forces in the field of petroleum refining, Fearon pointed out that all of our present refining processes depend basically on molecular changes resulting from thermal application, either alone or combined with a catalyst. Radio-activity application, however, can bring about changes in the atoms making up the molecules, resulting in rearrangements of the atoms that in turn create new molecular compounds hitherto unknown.

To geologists, according to Fearon, one of the most important possibilities of near term development is the examination of formation samples while they are exposed to radio-active rays. One potential application suggested by a geologist was the possibility that sub-divisions in the Ellenburger lime section of West Texas might be accurately identified through differences detected by some application of radio-active rays.

Fearon stated that use of radio-active isotopes of an element or compound as tracer bullets had already made substantial progress in certain scientific fields. In these fields the high cost of such isotopes as obtained by prewar atomic bombardment techniques was less important. Now with the cost so greatly reduced, many new applications could be expected to be tried.

These would generally fall into two groups. The first would be those in which the physical location of an object was sought; the second would be those in which the objective was the identification of the path followed by a particular compound or element in the course of a chemical reaction.

In the second, the speaker suggested that since sulfur could be made radio-active, petroleum refiners might be interested.

DEATHS

L. B. Jackson, 69, first president of the International Petroleum Exposition and first county attorney of Creek County, Oklahoma, died September 17 in Tulsa. Following a law course at Drake University, Jackson was admitted to the bar in 1900. Upon completing his term as Creek County attorney he entered the oil business. He was active in the development of pools in Oklahoma and Texas. He had been a director of First National Bank & Trust Co. in Oklahoma City since 1919 and at the time of his death was chairman of the board.

John P. Pugh, 59, drilling contractor, died September 13 in Shreveport. Pugh was the first president of Independent Oil Producers Association of Illinois and at one time was president of Arkansas Fuel Oil Co. in Shreveport. Later he was a member of Pugh-Hickman Drilling Co. and then became an independent contractor.

Frederick H. Searle, 70, manager of Monarch Petroleum Products Co., died September 8 in Columbus, Ohio. He was part owner of Mona Motor Oil Co.

James C. Wilhoit, formerly attorney for Tide Water Associated Oil Co. in Tulsa, died September 5 in Los Angeles.

Leroy B. Vernon, 39, industrial relations representative for Socony-Vacuum Oil Co., New York, died September 9. He was a graduate of Syracuse University.

No. 2

MIDDLE EAST REPORT

from the EDITOR

Anglo-Iranian Is World's Largest Single Integrated Operation in the Industry

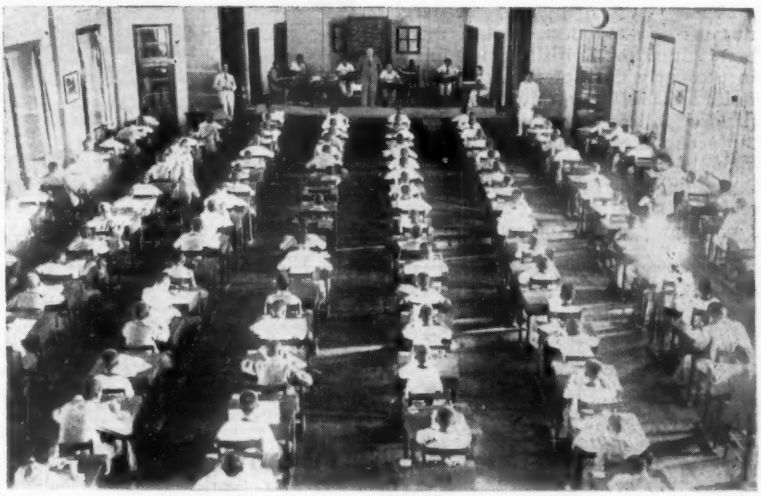
by C. O. Willson

This is the second of several articles on Middle East petroleum operations by the Journal's editor, who is making a first-hand investigation and fact-gathering trip to the Mediterranean and Persian Gulf producing countries. His next article will present a summary of field practices in Iran which are unique in their application and accomplishments.

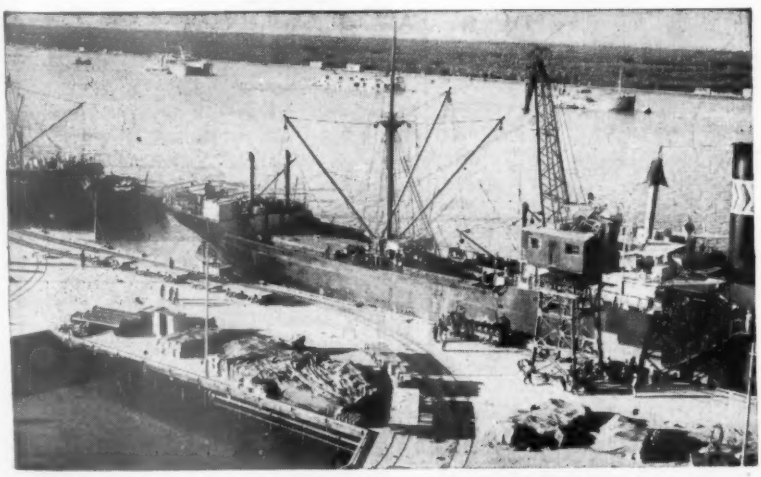
ABADAN, Iran. — A chart of the operations of the Anglo-Iranian Oil Co., Ltd., in Iran over the past 6 years would closely parallel the major developments of the war. As the largest single integrated operation of the petroleum industry its activities from month to month reflected the early Allied reverses of the war and later the consistent successes, terminating in complete victory.

When the war started, the company, either with crude oil or finished products, was a large supplier of petroleum consumed in several European countries and many marketing centers in Asia, Africa and Australia. Most of these operations were maintained until the German successes in 1940 and Italy's entry in the war.

When Italy became a belligerent the Mediterranean was closed and oil shipments from the Persian Gulf to the United Kingdom had to be routed via the Cape of Good Hope (South Africa) which doubled the length of the supply line. Even if the rate of consumption had merely remained constant—while in fact it was rapidly increasing—faster tankers, larger tankers or more tankers would obviously have been needed to maintain essential supplies. In fact, additional, larger or faster tonnage was not available. The U-boats were seeing to that. Consequently, the needed products had to be drawn from the nearest source of supply, the United States. This, the introduction of the "short haul" principle evoked in some ill-informed quarters the belief that the British were "conserving their oil"—a theory for which there was obviously no foundation.



Special attention is given to education of nationals in Iran



View of section of the water front at the Abadan refinery

In the dark days of 1941 this entire section was in effect part of the combat area with local difficulties unknown to those who at the time followed only the major war trends. The measures taken to protect this most valuable oil operation of the Allies outside Russia in this hemisphere are everywhere apparent.

Starting in 1942 operations here were changed again. Early in that year, oil products from the refinery largely replaced those of the East Indies and Burma countries which were occupied by the Japanese. The company also began fueling the supply lines from this area to Russia. Other products went to the Allied offensives in North Africa and the Mediterranean area.

Since then there has been a steady increase in oil production and refinery output with increasing em-

XUM

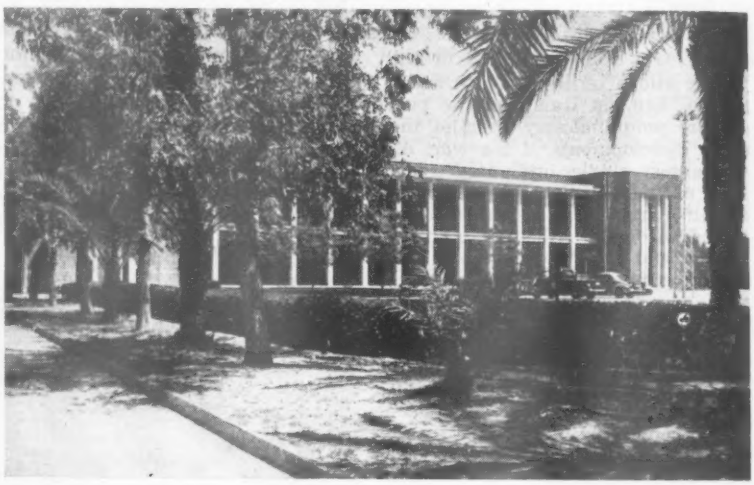
phasis on facilities for war production. Fortunately the five major fields of the company have been able to practically double their prewar output with a minimum of new materials and equipment. A number of new processing units have been installed at the refinery during the past 3 years and existing facilities enlarged. With these additions the refinery in crude-oil throughput became the largest of the petroleum industry with current runs to stills of approximately 360,000 bbl. daily. The refinery, until a few months ago, was the only manufacturer of 100-octane gasoline in the Eastern Hemisphere.

With the European war ended there were shifts in operations with emphasis placed on oil shipments to the east in support of the Allied offensives in the Pacific area. Preparations are now under way for resumption of civilian distribution in Europe and contiguous areas.

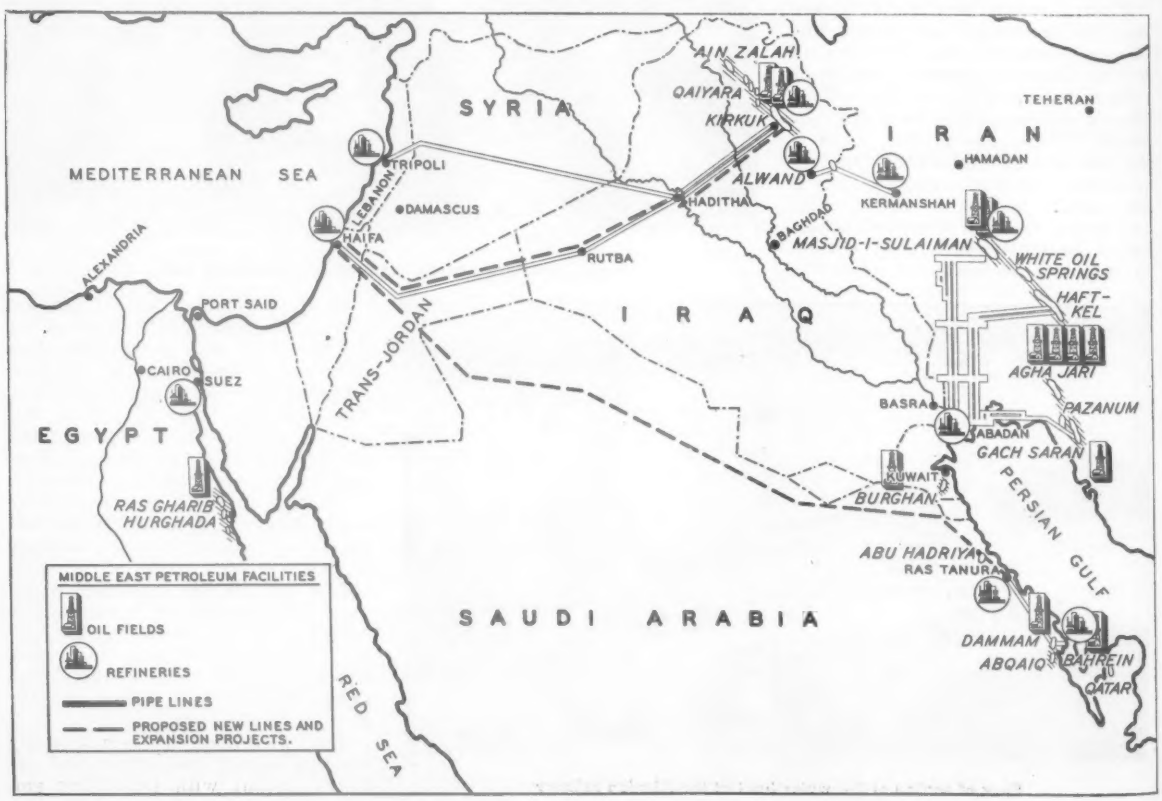
As in other parts of the oil world, the Anglo-Iranian expansion has been carried out with a shortage in materials and manpower. A large number of the younger staff members joined the British armed forces in the early days of the war. While field and refinery output was expanded in conformance with military schedules it was impossible to make corresponding increases in all the supporting operations. To correct this situation the company has a postwar program of rounding out its present operations with facilities which include extensive housing, enlarged utilities and the replacement of existing equipment and materials wherever necessary. New installations for the fields and refinery to take advantage of the latest development in operating practices are also projected.

No Parallel

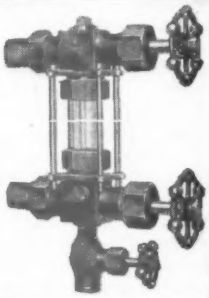
The activities of the Anglo-Iranian Oil Co., Ltd., are not paralleled by any other major operation of the petroleum industry. Its beginning dates back to 1908 when William D'Arcy and associates drilled the first successful test within what is now known as the Masjid-i-Sulaiman field and the present headquarters for the entire field operation. Gas and oil seepages which are found at several points in this area were responsible for the early interest of petroleum explorers. Landmarks near the discovery well from which the field derives its name are the ruins of Masjid-i-Sulaiman (Temple of Solomon) which is said to have been built by the



Central restaurant and club for bachelor employes



PENBERTHY
"ALL IRON"
WATER GAGE SET

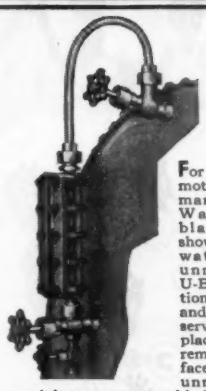


Extra heavy construction throughout. Body made from special high strength alloy iron, shanks alloy steel and trim stainless steel. Automatic and positive shut-off if glass breaks, valves self-cleaning, dripless drain cock permits gradual blowing off of gage. Conforms with A.P.I.-A.S.M.E. requirements.

The Heavy Duty "All Iron" is one of the complete line of Penberthy gages that meets every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT 2, MICH. Canadian Plant WINDSOR, ONTARIO

PENBERTHY
"REFLEX"
WATER GAGE SET

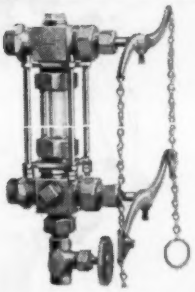


For oil field, locomotive type and marine boilers. Water shows black—steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

PENBERTHY
"NAVY TYPE"
WATER GAGE SET



Extra heavy construction made of "Navy Bronze Composition M." Important features include: regrinding valves, automatic and positive shut-off if glass breaks, valves self cleaning, glass offset from stems to allow cleaning from either end without loosening packing. Conform with A.P.I.-A.S.M.E. requirements.

The "Navy Type" is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT 2, MICH. Canadian Plant WINDSOR, ONTARIO

PENBERTHY
EJECTORS

Use the power of steam, air or water under pressure to lift liquids. Being simple jet pumps they have no moving parts and require no lubrication. A variety of models to meet different conditions. Also used as water heaters.

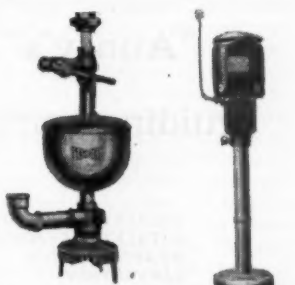
PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

PENBERTHY
AUTOMATIC INJECTORS

The accepted method for assuring an uninterrupted supply of feed water to oil field boilers. Penberthy Automatic Injectors will supply feed water to boilers at minimum cost, are quickly and easily installed, reliable under most severe operating conditions, require little attention and no careful handling. Highest quality design and rugged construction.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

PENBERTHY
SUMP PUMPS



Used wherever seepage water accumulates, the Penberthy Automatic Electric Sump Pump and the Penberthy Automatic Drainer (water or steam operated) have demonstrated their superiority in this service. Simple and rugged design—copper and bronze construction throughout.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

"Aunty Knock" and the UOP Kids

From the beginning, users of thermally cracked gasoline found its performance superior to straight-run products. Research and development disclosed the value of anti-knock in cracked gasolines.

"Aunty's" value and the need for her have been a guiding spirit of the entire UOP family.

CATALYTIC CRACKING
CATALYTIC REFORMING
HYDROGENATION
ALKYLATION
ISOMERIZATION

THERMAL CRACKING
THERMAL REFORMING
HYDROFORMING
DEHYDROGENATION
POLYMERIZATION

RETREATING
POLYTREATING
U. O. P. CATALYSTS
UNISOL TREATING
U. O. P. INHIBITORS

Universal Oil Products Co.
Chicago 4, Ill., U. S. A.

UOP

Petroleum Process Pioneers
For All Refiners

The Refiners Institute of Petroleum Technology

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Zoroastrians about 200 A.D. These people were fire worshippers and it is assumed that the seepage of gas was the source of the fire.

The D'Arcy concession later was taken over by what is now the Anglo-Iranian Oil Co., Ltd. Before the first World War the Government of Great Britain became directly interested in what had become an important oil operation through the purchase of 55 per cent stock interest which it retains at this time. The company owns a refinery at Grangemouth, Scotland, which during the war period has been operated with crude oil from countries other than Iran. During part of the war the Grangemouth plant was shut down. Anglo-Iranian also owns a large refinery at Llandarcy, South Wales. The company through subsidiary and affiliated interest is an operator of refineries in France and other countries. Probably the most important operation outside Iran is its 23¾ per cent interest in the Iraq Petroleum Co., Ltd., which in addition to its large operating concessions in Iraq has important concessions in Qatar and other sections of the Middle East. The company has a refinery and distributing facilities in Australia. It is a 50 per cent owner of Kuwait Oil Co., Ltd., which is now developing a valuable concession in Kuwait of this area.

In Iran the oil production operations center in five producing areas — Masjid - i - Sulaiman, Haft Kel, White Oil Springs, Agha Jari and Gach Saran.

These fields cover an area which extends from 160 miles north to 165 miles east of Abadan. The fields are located in a hilly area which has been compared to the North Kettleman Hills field of California. Actually most of the area is more rugged than Kettleman Hills and from a terrain standpoint presents more difficult operating problems.

The four largest fields—Masjid-i-Sulaiman, Haft Kel, Agha Jari and Gach Saran—are operated as separate units with general headquarters located at Masjid-i-Sulaiman. The fields' general management is located at the latter point with the principal engineering and geological offices located there. These operating facilities, including offices, laboratories, workshops, hospitals and housing, are to be enlarged after the war.

Remote from coast and any large Iranian city the company has the entire responsibility of maintaining living accommodations at Masjid-i-Sulaiman. For many years the sole transportation connection was the Karun River to point west of Masjid-i-Sulaiman and then by a company railway to the field. This operation is still used in the transportation of materials and many supplies. There is also a highway connection built by the company. The company began the use of airplanes in the late 20's and now four twin-engine planes furnish daily services out of Abadan to the fields and other operating points.

Main office building at Abadan

An apartment house for employes

The Masjid - i - Sulaiman water, light, fuel and sanitation facilities are comparable in size to those of a small city. An ice house, bottling works and the production of part of the required food supplies are among the activities of the field headquarters.

On a smaller scale, activities of the three other major producing fields duplicate those of Masjid-i-Sulaiman. While connected to the field headquarters by highway and air these other fields are remote and largely operated as independent units. Clubs for the European and Iranian staffs are maintained along with swimming pools and facilities for sports. British and American films, supplied by the company, are shown regularly at all the camps. Hospitals and adequate medical care are stressed in all operating centers. The company's improved highway system around Abadan and the fields totals several hundred miles.

Abadan

The realization that the development of a concession in this part of the world is far more than oil operation is further emphasized when a study is made of the activities at Abadan where the refinery and company's principal offices in Iran are located. Abadan is on an island about 20 miles from the upper end of the Persian Gulf. The island is surrounded by the Shatt-el-Arab and Bahmashire rivers. Sea-going tankers use the channel of the Shatt-el-Arab in loading at the refinery.

While the city of Abadan is an Iranian municipality with its own officers, the company, operating through the refinery management, largely provides for the living conditions of a population of approximately 100,000 people. The company has hundreds of private homes, flats and apartments for its employes in the city surrounding the refinery. It furnishes electric power and water to the city which has the responsibility of distribution. The management, cooperating with the city officials, has established utility services which are far superior to those commonly found in this part of the world.

The extensive hospital facilities built and operated by the company are available to employes and non-employes. Particular attention is paid to everything that has to do with the health of employes. The summer shade temperatures at Abadan range up to 120° F. and this fact is taken into consideration in the working schedules. The present work day starts at 5:30 a.m. From 9:30 to 10:30 is the breakfast period

with all transportation to and from work supplied by the company. The working day except for the shift workers ends at 2 p.m. A start had been made in supplying air conditioning for offices, homes and clubs when the war caused a temporary interruption in the program.

Food Supplies

The writer visited a farm, gardens and a dairy farm which are operated by the company. Even in normal times this part of Iran was dependent on other sections for a large part of its food supplies. This situation was aggravated by the war due to the interference with shipping. The company solved this problem in part by giving every possible encouragement to the production of local supplies. It has been found that by careful planning and the use of irrigation most of the farm and garden products which are found in the southern part of the United States can be produced here where agricultural activity for centuries has been largely confined to the raising of dates.

While the company operated its own farms during the war to aid in bridging the food emergencies the long-range objective is to encourage nationals to engage in agricultural activities which will eventually make this part of Iran more independent in the matter of supplies. The company's special agricultural activities are coordinated with those of the Iranian Government. The maintenance of adequate supplies requires large storage facilities. Four restaurants for the use of employes during working hours are operated by the company. All these operations coupled with rationing and price controls gave an important protection to employes during a war period in which the results of inflation are everywhere apparent. The company at this time has more than 50,000 employes of which approximately 35,000 are located at Abadan.

Training of Nationals

All but approximately 2,000 British employes are Iranians. It has been the policy of the management for many years to train Iranians for responsible positions in the operations and they are now in charge of many phases of the company's activities.

The writer was particularly impressed with the results that have been obtained in what is called the "Artisan Apprentice Training Course" and the "Technical Apprentices Training Course". The first course is open to Iranian boys of 14 years or older who have completed Class 4 in the Persian Primary School. These boys with little educational background and no industrial experience are given a probationary training in elementary shop work for 6 months followed by 1½ years in shop training. Then they start a 3-year apprentice period in the refinery under the direction of a department established for that purpose. The Technical Apprentice Course is for boys who have had more school training and is completed in 4 years. The objective is to train nationals who are capable of holding responsible positions at the refinery. Approximately 500 Iranians are enrolled in these courses at this time. Students are paid by the company during the training period and living accommodations are provided.

Technical Institute

For more advanced training the company built and is now operating in cooperation with the Iranian Ministry of Education a Technical Institute. The facilities of this institute are comparable to those of a small college in the United States. The work of the institute ties in directly with the operations of the company and its 350 students are company employes. Living accommodations are provided. Employment with the company is arranged so that students can attend classes, some of which are held at night.

The work of the institute is designed to take care of the varying educational requirements of the Iranian employes. Four main engineering courses are provided: (1) Petroleum chemistry; (2) petroleum-plant operation; (3) mechanical engineering, and (4) electrical engineering. Students for these courses are selected by examination. When studies are successfully completed, graduates are given scientific degrees which are generally accepted in the Iranian university system. The institute is headed by a principal and faculty working with the advisory committees from the company. The institute provides a number of special classes including courses in the Iranian language for English employes.

Stevenson to Head List of Gas Witnesses at Dallas

AUSTIN. — Gov. Coke Stevenson is scheduled to be the first of 22 witnesses who will present this state's position in the Federal Power Commission's natural-gas investigation when that agency opens one of its regional meetings in Dallas November 27. He will discuss state rights and the place the natural-gas industry holds in Texas.

Olin Culberson, chairman of the Texas Railroad Commission, is to follow the governor, explaining the commission's gas-conservation policy and defining the state's attitude toward federal regulation of production, processing, and gathering of natural gas.

Charles I. Francis, Houston, is chairman of a legal subcommittee which will coordinate the presentation of evidence. Other subcommittee heads are D. A. Hulcy, Dallas, president Lone Star Gas Co., economics and statistics; Dr. Everette Lee DeGolyer, Dallas, engineering.

Witnesses in addition to the governor and Culberson are to testify in the following order:

Ernest O. Thompson, Railroad Commission member, progress of oil and gas conservation under the commission.

Beauford H. Jester, commission member, the state's interest in its natural resources.

Atty. Gen. Grover Sellers, Texas gas conservation laws and regulations.

Dr. DeGolyer, natural-gas problems and principles which should guide their solution.

Maston Nixon, Corpus Christi, president Texas Mid-Continent Oil and Gas Association, the producer's viewpoint.

R. C. Kay, Amarillo, president Panhandle Producers and Royalty Owners Association, the land and royalty owners' viewpoint.

Mayor J. Woodall Rodgers, Dallas, the consumers' viewpoint.

H. H. Power, chairman, and George H. Fancher, professor University of Texas department of petroleum engineering, and Harold Vance, head of the department of petroleum engineering at A. & M. College, joint presentation of the public viewpoint.

George A. Hill, Jr., Houston operator and member of the Governor's advisory committee, free play of economic forces in the end use of gas.

Dr. R. J. Gonzales, Houston, Humble Oil & Refining Co., gas prices and conservation.

Hulcy to Appear

D. A. Hulcy, transportation and use of gas in Texas.

N. C. McGowen, Houston and Shreveport, United Gas Co., interstate gas transmission lines.

L. T. Potter, Dallas, Lone Star Gas Co., production of dry gas.

S. E. Buckley, Houston, Humble Oil & Refining, production and conservation of casinghead gas.

Robert Wilson, Corpus Christi, La Gloria Corp., cycling-plant operation.

M. L. Mayfield, Houston, secretary natural-gas and natural-gasoline committee for District 3, Petroleum Administration for War, operation of natural-gasoline plants.

E. M. Eckhardt, Borger, Huber Corp., use of gas for carbon-black manufacture.

R. C. Alden, Borger and Bartlesville, Phillips Petroleum Co., use of natural gas for chemicals and liquid fuels.

Refiners Will Have Short Reprieve From Octane Race

by Arch L. Foster

THE major refiners may 'put a monkey' on our backs", a prominent and long-experienced Mid-Continent independent refiner said a few days ago when asked about the necessity for building a catalytic-cracking unit. "Where they set the octane levels decides whether we independents have to build cat crackers or not. If those levels are too high, we either get catalytic-cracking units or get out of the motor-fuel refining business." And that refiner gives us 2 years from V-J Day to reach the critical decision.

Refiners point out that until about 2 years have passed the percentage of automotive engines on the road which will actually demand octane ratings above 74-75 for satisfactory performance will be small but will increase rapidly. In fact, competition within the refining industry itself will do far more to force a boost in antiknock quality than will any requirements of the engines. Throughout the country reports say that certain major refiners are already boosting the octane rating of housebrand fuel, some reputed to be raised to 76.5 octane rating. Motor fuel already in the finished gasoline tanks is being releaded to raise it to the higher levels. This is going on all along the Mississippi Valley and contiguous areas, it is understood. It is stated freely by some responsible executives that within 2 years housebrand motor fuel will be showing 80-82 A.S.T.M. octane number. "There seems to be no reason for this climb, except competition within the industry itself," one executive stated. "And I see no possible way to stop it, even though our engines, most of them, do not need it now." This executive hurried to point out that as new engines come on the market, the need for higher octane ratings will increase importantly. One major refiner is reported to be planning the advertising and sale of his product on the basis of road octane numbers, which change will place the numerical value of this property probably well up in the 80s. Rumor has it that in the north and eastern sections of the country 76.5 and higher octane-number fuels are being placed on the market by more than one major refiner, upsetting the smaller refiner's applecart seriously.

That an important rise of octane ratings will come within that approximate 2-year period no competent refiner appears to doubt. Refiners, mostly major integrated companies, have now available to operate a total catalytic cracking charge capacity of 1 million barrels, or a catalytically cracked gasoline capacity of roughly ½ million barrels per day. Some of these units, a majority of them it seems, are owned by these companies in fee simple; the others may be purchased from Defense Plant Corp. for prices ranging from 15 per cent of the original war cost upward.

To expect these refiners to hold in check indefinitely this potential advantage in sales is to turn against all the experience of the refining industry. Efforts to hold back at least a gradual octane number rise are like sweeping at the tide with a broom.

When Will Race Start?

The only question remaining in the refiners' minds is: When will it actually start; how fast will it go? Executives appear to believe that it will start somewhat slowly and gather momentum as time goes on. We can make 74-75 octane number gasoline (ASTM Motor Method numbers are referred to here throughout), they say, for housebrand, even with making a few per cent of premium grade at 79-80. A Western Petroleum Refiners Association survey report states that the following refinery antiknock grades of gasoline are expected: 60 and below; 64-67; 73-75, with a premium between 78 and 80. These will correspond to a sub-third grade, third grade, housebrand and premium or Ethyl grades. The lowest grade will be for bulk sale only, probably, and will not be offered at retail.

Several refiners say they cannot go above about 75-octane number for housebrand fuel without excessive losses and costs that are prohibitive. Even those operating polymerization units, most of which have been making codimer, are fearful of the cost if octane ratings go above 75. Only one refiner interviewed recently states that he expects to operate his alkylation unit; with that blending material he can compete with catalytically cracked products, he says. All others are either dubious of the cost of alkylation or are certain that they must shut down these plants entirely, for motor-fuel production. The choice between alkylation and catalytic-cracking units as producers of octane-improving stocks must be made after study of numerous factors.

Summary of Problems

Summarizing, the following are some of the problems which plague the smaller independent refiner in arriving at a conclusion for action in modernizing his processes:

1. No refiner can afford to buy new processes without having at his command an adequate supply of crude for a period of 5 to 10 years. He must also have some idea of what to expect in future marketing conditions.

2. Catalytic cracking processes have not been proved feasible in the capacities which can be used by the smaller refiners, say 2,000-3,000 bbl. per day charge.

3. For the present, the fixed-bed, simple design catalytic units appear to have the edge over the moving-bed types of units, mainly because of purported lower initial investment costs as well as probable lower operating costs. This is the present opinion of a number of refiners who have studied carefully the different units and their possibilities. New developments in design may change these conclusions overnight.

4. Catalysts for cracking must be cheaper than they have been so far in the history of the art. Natural catalysts which are cheap enough to throw away without full regeneration are preferable, if obtainable. Cheaper catalysts are preferable even though yields and octane ratings are lower than from the synthetic catalysts in the larger capacity units.

5. While some natural catalysts, low in cost, show lower octane numbers and lowered yields of motor fuel than the best synthetic catalysts, the apparently lower costs of processes using them will permit the refiner to own and operate units when the most expensive, more efficient units can not be carried economically.

6. For the immediate future and for an indefinite period, the average refiner will need only a few additional octane numbers, 3 to 5 for example, to enable him to compete. Any process, catalytic or non-catalytic, which will give him this small boost at a low cost will enable him to compete in the motor-fuel field whereas an expensive unit would bankrupt him under expectable price and market conditions.

7. A higher TEL limit should be set, in the opinion of some refiners, to cover their shortcomings in octane ratings until economics will permit them to use cat cracking.

XUM

Four cubic centimeters is mentioned as a probable reasonable limit to replace the present 3 cc. for motor fuel. Although the fourth cc. improves octane number less than does the first and second, it can easily mean, for stocks of good lead susceptibility, the difference between competing on an even basis and being left hopelessly behind when operating without a cat cracker.

8. Labor costs, and the rate of wage increases will govern a large part of the extra cost of motor-fuel refining. One refiner expects that an increase of 15-20 per cent in take-home pay for refinery workers will become effective within a year.

Other Factors in Dilemma

Other factors are involved in the refiners' dilemma, but those mentioned above appear to be the major difficulties. These independent operators represent at least 500,000 bbl. per day of refining capacity in terms of crude, with approximately 200,000 bbl. daily of thermal cracking capacity, most of it modern as of 1941.

To summarize what these refiners are doing or plan to do, and omitting such companies as Phillips, Continental, Socony-Vacuum's White Eagle division, Root Refining and Frontier, all of which have cat cracking capacity installed.

Only one refiner plans to buy a catalytic cracker in the near future, of the fixed-bed type, and that decision is not yet final.

The majority of the executives interviewed say they can meet the 75 housebrand and 79-80 premium levels with existing equipment.

One refiner is installing a vapor-recovery unit, and a superfractionator tower for his cracking system. One is adding a third coil to his thermal cracker, and conbining the streams of his two-part polymerizer unit. One plans to operate his HF alkylation unit, and to cut endpoints on cracker streams. Another will shut down his alkylation unit as too expensive to operate, will complete a reforming unit and continue improved lubricating oil plans. Still another will stop running sour West Texas crude because federal compensatory payments stopped with V-J Day, run at reduced capacity on other crudes. Two or more catalytic polymerization units will go in as soon as equipment and construction service can be had, probably a matter of weeks. Still another enterprising refiner is busy pouring foundations on a fractionation-thermal-cracking, catalytic-cracking combination in which for the present the catalytic section will remain "on paper" but may be installed at any time the situation demands it. This type of combination unit, most refiners seem agreed, is indicated as the preferred type for the future; complementary combinations of thermal and catalytic cracking have been recommended before this by some authorities and are expected to be the rule in the future refinery.

All or practically all DPC units such as those at the plants of Continental, Associated Refineries, and elsewhere are shut down, awaiting disposal. The Associated plant at Duncan, Okla., is reported cold. Continental has just announced a 90-day lease on its DPC units, an interim move while studying meticulously the problem of purchase of these units. White Eagle at Augusta doubtless will operate its catalytic crackers, less certainty about other units although officials have made no statement at all. Similarly no word is obtained from Lion as to the alkylation and cracking units at El Dorado. Phillips officials have announced that it will continue to operate the various units at Borger, that company being heavily in the aviation-fuel and synthetic-rubber fields. The price which DPC quotes for its several units to prospective purchasers will govern almost entirely what will be done with those units.

It is understood that at least one refiner has made a contract with another refiner who operates catalytic cracking as well as alkylation units, to purchase a relatively high-octane-number blending stock sufficient to bring up his total housebrand product to competitive levels, or, say, 76-77 octane number. It is highly probable that for the next year or two, probably longer, refiners with such units may carry a considerable part of the load of hoisting octane levels by supplying refiners who do not have these cracking and/or alkylation with blending naphthas to raise their too-low octane ratings and enable the latter to stay in the motor-fuel race. Such a contingency may keep some of these wartime plants operating which otherwise might shut down entirely.

The position of natural gasoline now more than ever should be that of aid and helper to the refiner to meet not only volatility competition but to boost either octane number per se of motor fuels or its TEL susceptibility to enable the refiner to meet the competition of the majors. Since improvement in either of these factors is highly important, it may well be that refiners may buy higher-vapor-pressure naturals for the added octane rating they possess. Octane number of butanes ranges from 92 Motor Method to 100 or higher Research Method and has all the advantage of alkylate—isooctane—as a blending agent, if the volatility of the base stock will permit use of appreciable quantities of butanes.

As to lubricating-oil refining, the use of solvent refining for all grades except the cheapest, probably unbranded, grade appears to be inescapable. Four grades are expected, a prominent refiner says. A solvent-treated housebrand oil, treated also with an inhibitor, possibly with film strength, detergent or other addition agents will be the premium retail oil. A commercial, heavy-duty oil strongly reinforced after solvent refining will be supplied for trucks buses, etc. A general purpose, H.D oil meeting 2-104B specifications will also be necessary. These last two grades will not be made by all refiners producing lubricants, but will be purchased from large suppliers or specialized lubricant suppliers. A cheaper, competitive unbranded oil, sold often under the individual marketer's housebrand, refined conventionally and probably from either mixed-base or naphthenic crudes will be the product most commonly made by refiners without ultramodern refining facilities.

The independent refiner has plenty of problems to occupy his attention. One refiner says the independent is nearer extinction than ever in his history.

No Need for Worry About Oil Shortage, Says Fell

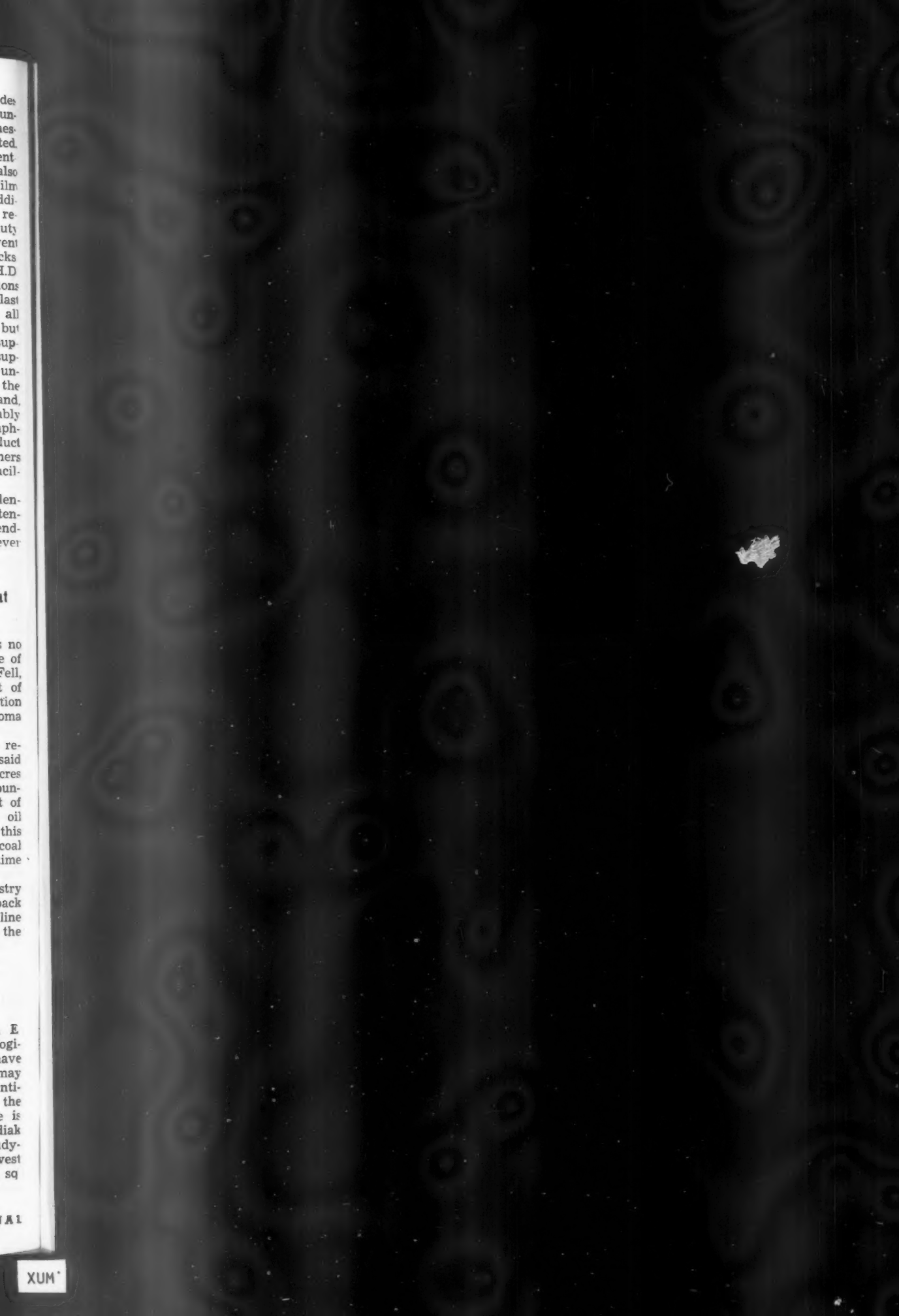
OKLAHOMA CITY.—There is no need for worry about a shortage of petroleum fuels, Harold B. Fell, Ardmore, Okla., vice president of Independent Petroleum Association of America, assured the Oklahoma City Geological Society.

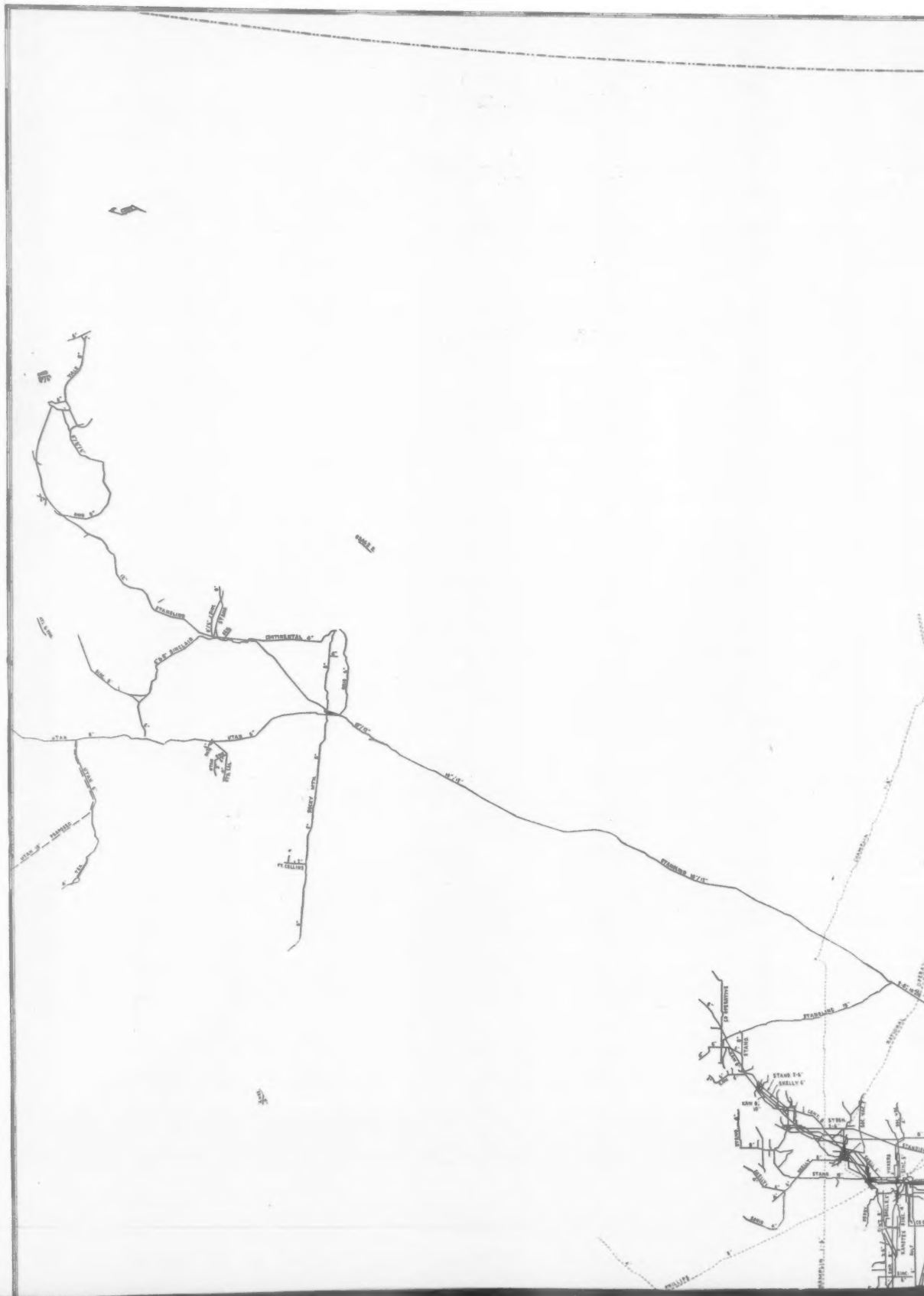
"As far as finding new oil reserves, we are not washed up," said Fell. "There are millions of acres of untested reserves in this country. If we ever should run out of crude petroleum, we can get oil from the vast shale beds of this country and later turn to the coal deposits—and maybe by that time atomic power will be here."

Fell said, however, the industry would have a temporary setback since demand probably will decline as much as 1,000,000 bbl. daily the first year after the war.

Indications of Oil Seen Near Alaska Peninsula

WASHINGTON.—William E Wrather, director of U. S. Geological Survey, says indications have been found that an oil reservoir may be disclosed in the wide bay anticline on the Pacific side of the Alaska Peninsula. The anticline is about 150 miles west of Kodiak Island. Geologists have been studying 60 sq. miles near the southwest end. The anticline comprises 300 sq miles.





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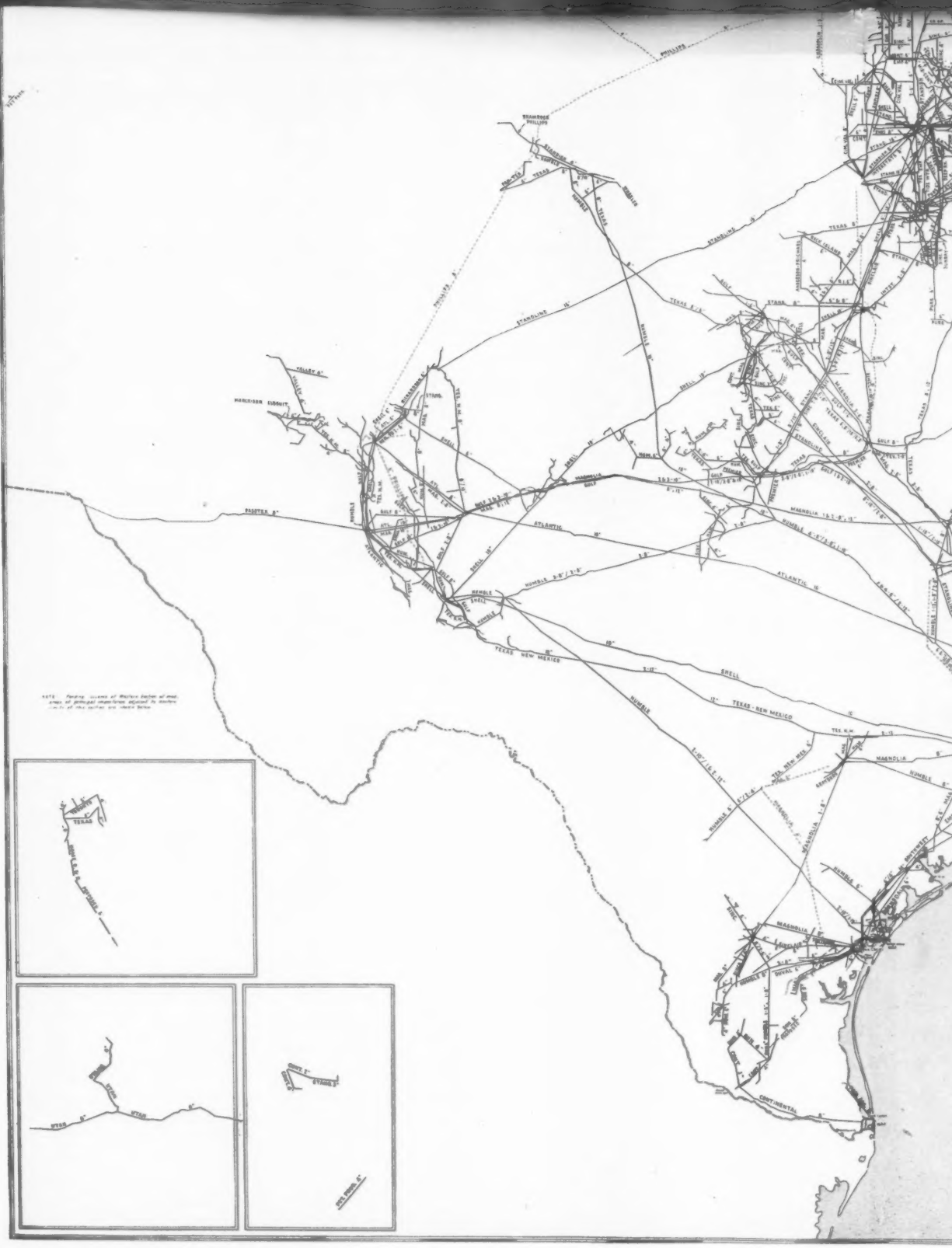
LAKE MICHIGA


PHILLIPS
STANDARD
TEXAS
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GULF
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MAGNOLIA
TEXAS - NEW MEXICO
CONTINENTAL
TEX. N.M.
STANOLIND
ROOSEVELT
HARRISON CUDDAHY
VALLEY
BRAINTREE
BRAINTREE PHILLIPS
NOTE: Pending issuance of Railroad Section of map, areas of principal expenditures appeared in months ... in all of this section are shown below.

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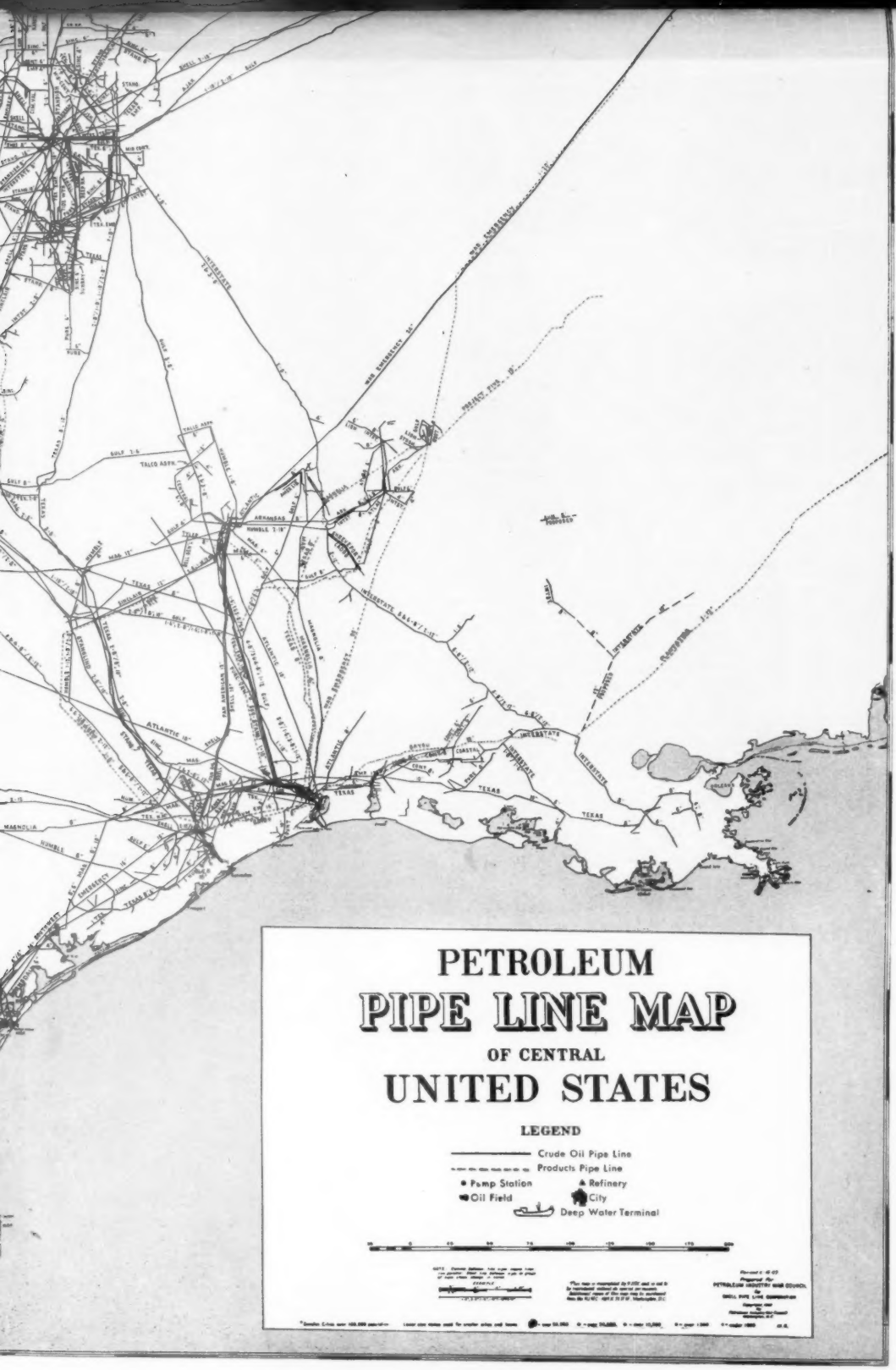

PETROLEUM
PIPE LINE MAP
OF CENTRAL
UNITED STATES

LEGEND

- Crude Oil Pipe Line
- Products Pipe Line
- Pump Station
- Refinery
- Oil Field
- City
- Deep Water Terminal

XUM*

LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
COMMONWEALTH
LEONARD
SIMBALL
PURE
PRODUCERS
BUCKEYE
SOUTHERN
NORTHERN
SOUTHWEST PENN
TIDE WATER
NATIONAL TRANSIT
NEW YORK TRANSIT
EMPIRE TRANSIT
EQUITABLE
PENNSBORO AND ASHLAND

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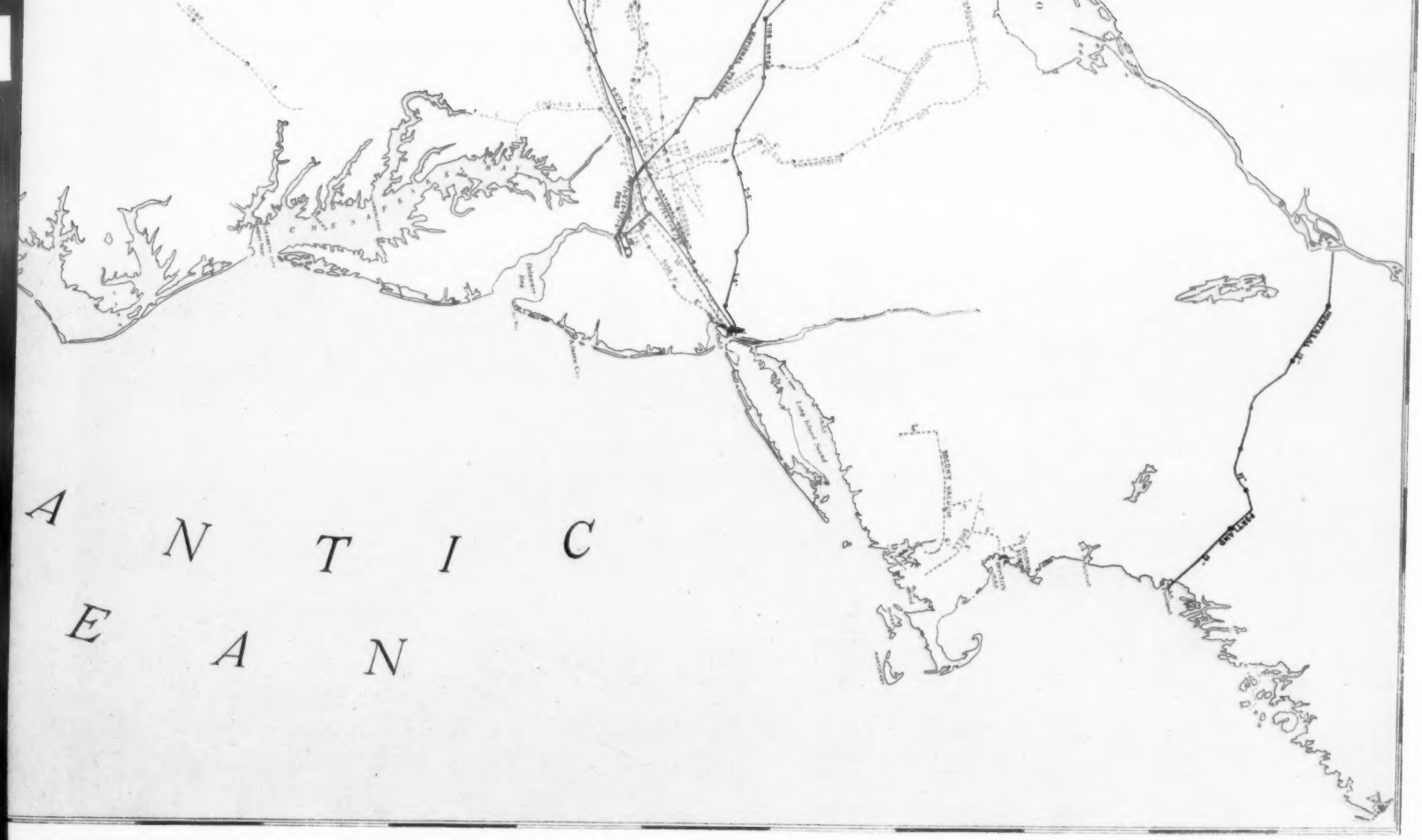
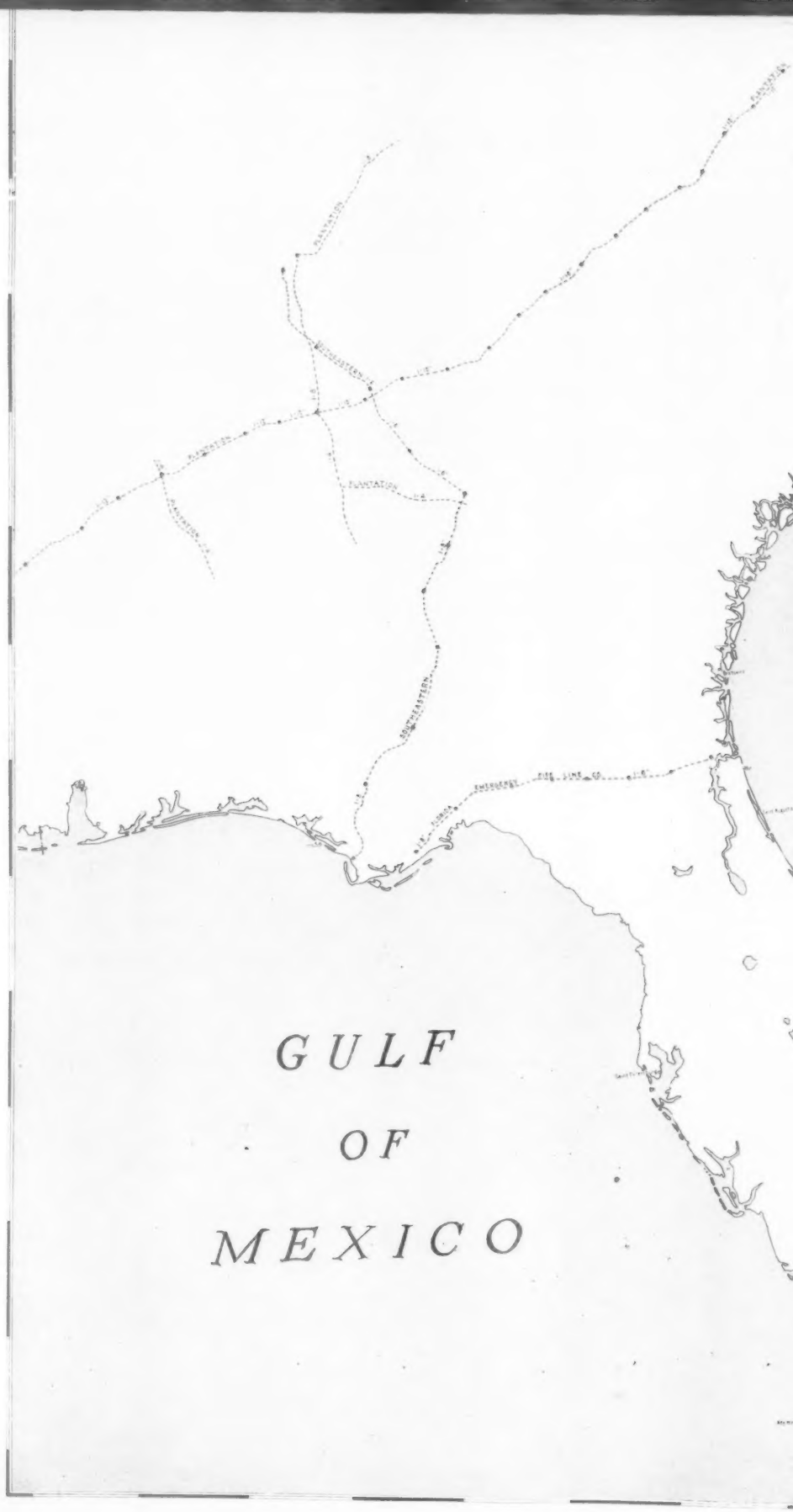
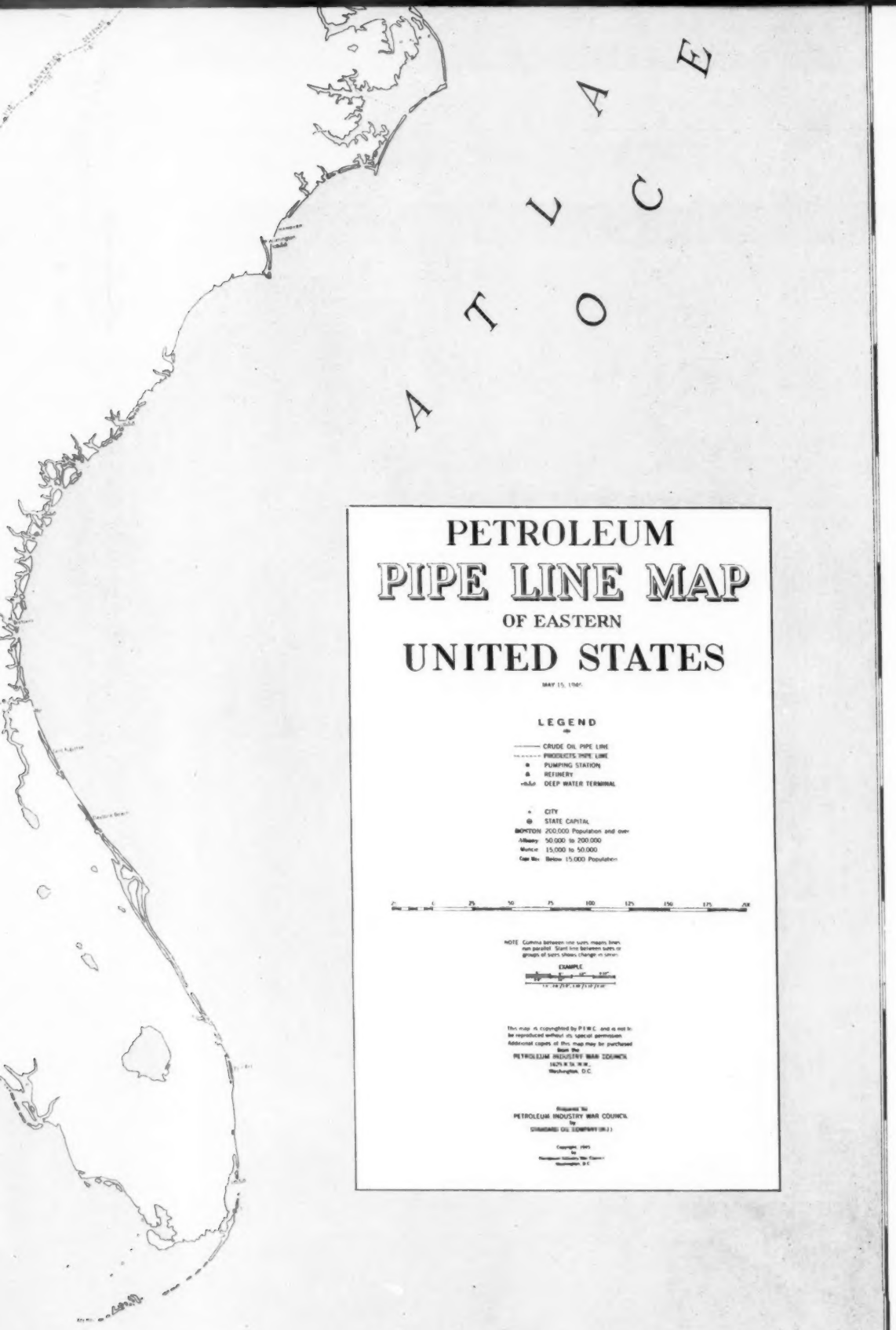

A N T I C
E A N


GULF
OF
MEXICO



PETROLEUM
PIPE LINE MAP
OF EASTERN
UNITED STATES

MAY 15, 1945

LEGEND

- CRUDE OIL PIPE LINE
- PRODUCTS PIPE LINE
- PUMPING STATION
- REFINERY
- DEEP WATER TERMINAL
- CITY
- STATE CAPITAL

BOSTON 200,000 Population and over
Albany 50,000 to 200,000
Muncie 15,000 to 50,000
Cape May Below 15,000 Population

NOTE Gumma between one sizes means lines run parallel Slant line between sizes or groups of sizes shows change in sizes

EXAMPLE

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PETROLEUM INDUSTRY WAR COUNCIL
1625 K St. N.W.,
Washington, D.C.

Prepared for
PETROLEUM INDUSTRY WAR COUNCIL
by
STANDARD OIL COMPANY (N.J.)

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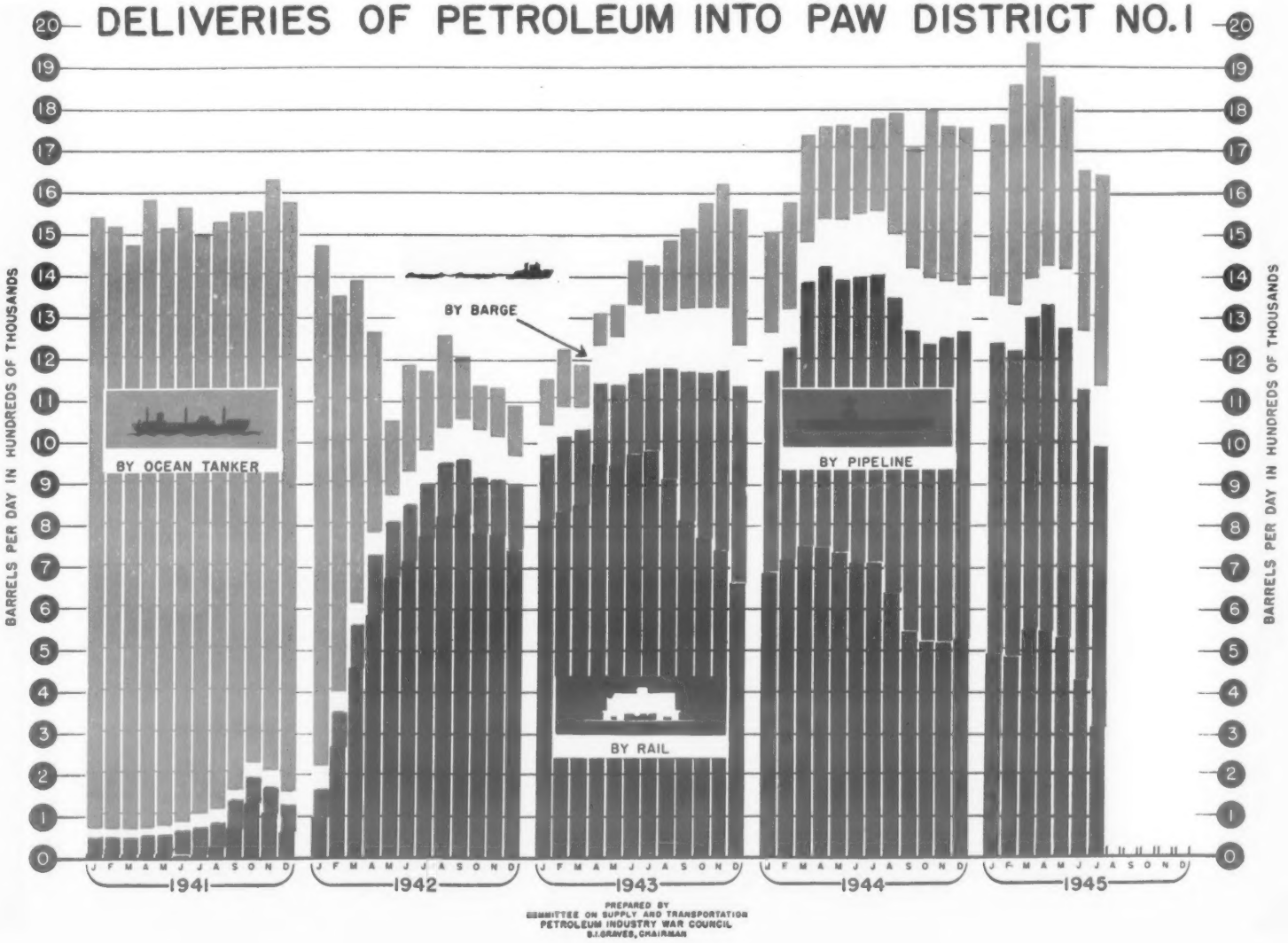

DELIVERIES OF PETROLEUM INTO PAW DISTRICT NO. 1
BARRELS PER DAY IN HUNDREDS OF THOUSANDS
BARRELS PER DAY IN HUNDREDS OF THOUSANDS
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
BY OCEAN TANKER
BY BARGE
BY RAIL
BY PIPELINE
J F M A M J J A S O N D
1941
1942
1943
1944
1945
PREPARED BY
COMMITTEE ON SUPPLY AND TRANSPORTATION
PETROLEUM INDUSTRY WAR COUNCIL
B.I. GRAVES, CHAIRMAN

Natural Gas Trunk-Line Construction (Reported Miles Per Year)

Size (in.)	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	.....	.....	.....	.....	20.00	29.00	83.00	.....	.....	11.00
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	.....	.....	.....	115.00	20.00	66.00	28.00	23.00	11.00	31.50
8	40.14	65.00	.....	387.00	92.00	125.00	94.00	75.00	62.00	29.00
10	.....	49.00	29.00	26.00	41.00	.....	51.00	22.00	33.00	30.00
12	131.08	147.00	20.00	6.00	43.00	179.50	197.00	.....	15.00	28.00
14	94.00	65.00	.....	.....	.....	140.00	.....	.....	18.00	.....
16	3.00	100.00	194.00	142.00	12.00	135.40	83.50	.....	12.00	78.00
18	.....	51.00	53.00	73.00	128.00	118.90	118.00	.....	.....	62.00
20	108.00	93.08	.....	63.00	125.00	60.00	41.00	80.00	.....	50.00
22	172.00	314.00	.....	.....	35.00	105.00	.....	.....	101.00	17.00
24	2.50	.....	.....	.....	238.00	48.00	2.00	90.00	906.50	112.00
26	.....	.....	.....	.....	.....	310.00	83.00	411.00	347.00	.....
Misc.	.....	.....	.....	.....	.....	.....	92.00	92.00	93.00	.....
Total	550.72	884.08	296.00	812.00	754.00	1,316.80	872.50	793.00	1,598.50	448.50

Natural Gas Gathering-Line Construction (Reported Miles Per Year)

Size (in.)	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
2	.....	.....	.....	.....	9.00	14.00	.....	.....	.....	5.00
3	.....	8.00	.....	18.00	20.40	10.00	7.50	.....	14.70	5.00
4	.....	.....	0.60	47.10	49.00	89.70	19.00	10.00	51.30	10.70
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.50
6	.....	.....	4.00	25.20	38.20	69.10	10.30	.....	33.80	6.40
8	.....	.....	9.00	12.50	59.10	49.20	30.00	.....	7.60	12.00
10	.....	5.50	20.90	3.40	14.50	.....	10.00	.....	1.70	4.00
12	.....	.....	11.60	2.60	41.20	7.00	122.20	22.00	14.80	25.80
14	.....	.....	7.20	6.00	3.20	.....	17.50	14.80	8.20	31.50
16	.....	.....	7.30	6.10	3.30	4.00	17.50	14.80	8.30	31.50
18	.....	.....	.....	7.70	.....	.....	.....	.....	1.00	.....
20	.....	.....	.....	7.70	.....	.....	.....	0.30	1.00	.....
22	.....	.....	.....	0.50	.....	.....	.....	.....	.....	.....
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Misc.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	13.50	60.60	137.80	237.90	243.00	234.00	61.90	142.40	132.40

Contractors supplying pipe-line construction data have built 60 to 80 per cent of all lines laid during the 10-year period covered

Crude Oil and Products Trunk-Line Construction (Reported Miles Per Year)

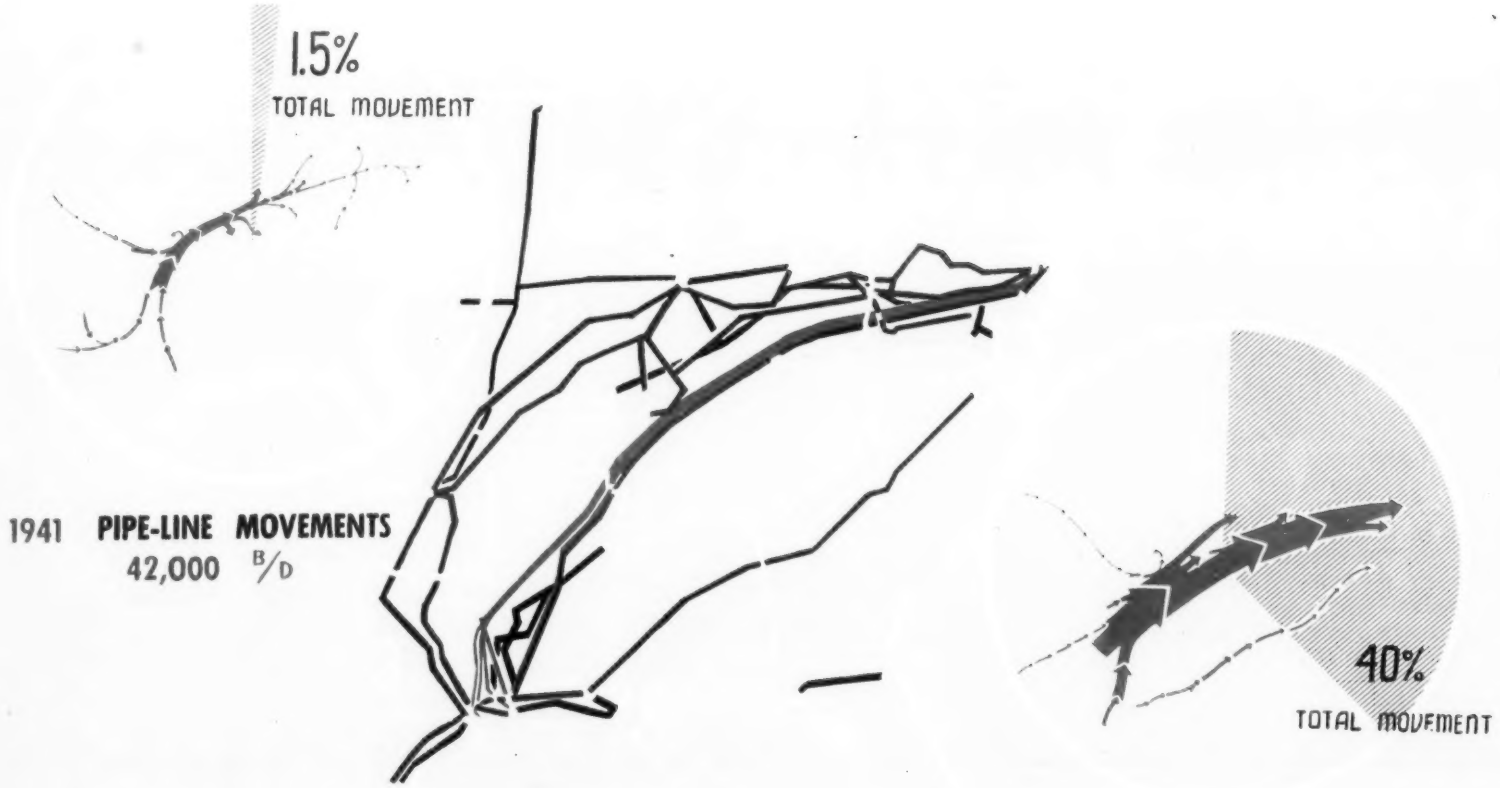
Size (in.)	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
2							88.00	566.00	88.00	
3							201.00	202.00	202.00	
4	35.00	11.00	35.00	154.00	470.00	49.00	200.00	567.00	265.00	
5										
6	625.00	723.00	299.20	595.00	200.00	1,103.03	336.90	688.00	244.12	177.40
8	602.39	738.14	516.98	982.98	1,061.86	836.37	1,416.90	508.43	466.92	51.64
10	324.43	247.50	335.92	803.42	322.63	675.66	302.50	410.00	146.31	172.40
12	372.00	75.84	31.25	38.75	488.00	754.13	177.50	70.00	104.95	183.00
14						8.00				
16	12.00	22.00		100.00	8.00		30.00	208.00	163.50	
18										
20								763.19	73.80	
22	48.00									
24							167.00	513.20	113.00	
26										
Total	2,018.82	1,817.48	1,218.35	2,674.15	2,550.49	3,426.19	2,919.80	4,495.82	1,967.60	584.44

Crude Oil and Products Gathering-Line Construction (Reported Miles Per Year)

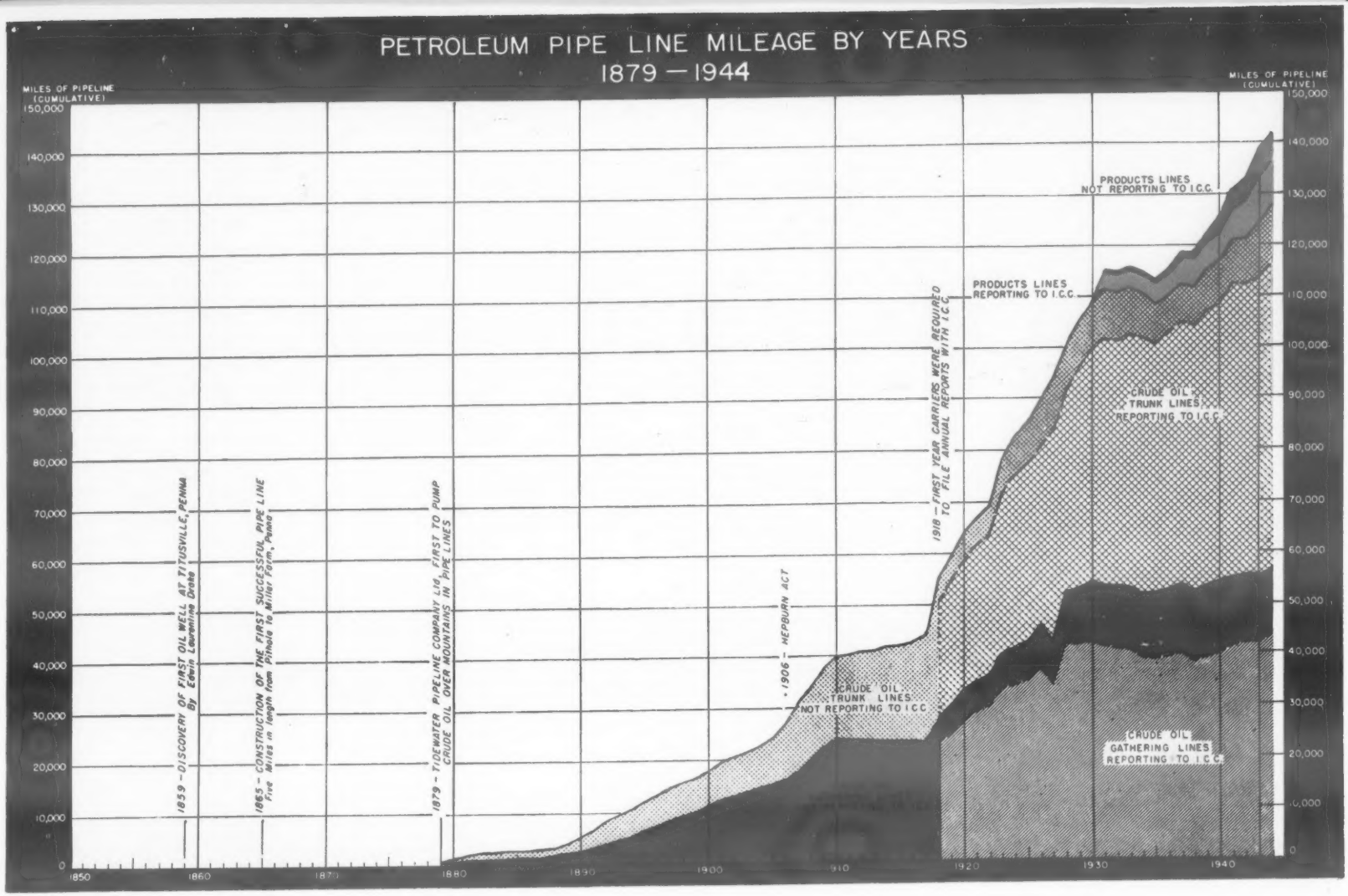
Size (in.)	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
2										
3		24.00		9.00	13.00	6.00			32.00	2.70
4		24.00	37.40	54.60	103.70	37.10	18.80	109.90	66.50	104.40
5						2.00				
6		71.50	44.90	93.60	66.20	181.90	16.60	112.40	81.00	18.30
8		72.70	10.60	72.70	209.00	19.10	10.30	144.10	8.00	7.50
10		1.00			28.00		8.00	15.10	5.00	0.50
12		2.00	8.80		1.50	1.00		25.20		
14		0.30			2.00	0.20				
16		0.40			2.00	0.30				
18										
20										
22										
24										
26										
Misc.			11.00				18.00			75.00
Total		195.90	112.70	229.90	425.40	247.60	71.70	406.70	193.30	208.40

Contractors supplying pipe-line construction data have built 60 to 80 per cent of all lines laid during the 10-year period covered

HOW PIPE LINES FILLED THE BREACH WHEN TANKERS WERE UNAVAILABLE



PETROLEUM PIPE LINE MILEAGE BY YEARS
1879 — 1944



Growth of Pipe-Line Industry

(Data from Office of Defense Transportation)

Year	Crude Oil Lines						Products Lines			Grand Total
	Trunk			Gathering			Trunk			
	Reporting to ICC	Not Reporting to ICC	Total	Reporting to ICC	Not Reporting to ICC	Total	Reporting to ICC	Not Reporting to ICC	Total	
					M I L E S					
1879	-	322	322	-	372	372	-	-	-	694
1880	-	702	702	-	514	514	-	-	-	1,216
1881	-	1,215	1,215	-	619	619	-	-	-	1,834
1882	-	1,386	1,386	-	687	687	-	-	-	2,073
1883	-	1,427	1,427	-	810	810	-	-	-	2,237
1884	-	1,427	1,427	-	948	948	-	-	-	2,375
1885	-	1,427	1,427	-	1,062	1,062	-	-	-	2,489
1886	-	1,496	1,496	-	1,126	1,126	-	-	-	2,622
1887	-	1,655	1,655	-	1,165	1,165	-	-	-	2,820
1888	-	1,953	1,953	-	1,609	1,609	-	-	-	3,562
1889	-	2,097	2,097	-	1,995	1,995	-	-	-	4,092
1890	-	2,938	2,938	-	2,457	2,457	-	-	-	5,390
1891	-	3,491	3,491	-	3,118	3,118	-	-	-	6,609
1892	-	4,956	4,956	-	3,594	3,594	-	-	-	8,550
1893	-	5,446	5,446	-	4,344	4,344	-	-	-	9,790
1894	-	5,493	5,493	-	5,132	5,132	-	-	-	10,625
1895	-	5,720	5,720	-	6,387	6,387	-	-	-	12,107
1896	-	6,306	6,306	-	7,268	7,268	-	-	-	13,574
1897	-	6,478	6,478	-	8,302	8,302	-	-	-	14,780
1898	-	6,673	6,673	-	9,107	9,107	-	-	-	15,780
1899	-	6,673	6,673	-	9,990	9,990	-	-	-	16,663
1900	-	6,821	6,821	-	11,152	11,152	-	-	-	17,973
1901	-	7,422	7,422	-	12,392	12,392	-	-	-	19,814
1902	-	7,744	7,744	-	13,056	13,056	-	-	-	20,800
1903	-	7,976	7,976	-	13,799	13,799	-	-	-	21,775
1904	-	8,305	8,305	-	14,686	14,686	-	-	-	22,991
1905	-	9,337	9,337	-	15,329	15,329	-	-	-	24,666
1906	-	11,065	11,065	-	16,000	16,000	-	-	-	27,065
1907	-	13,504	13,504	-	17,955	17,955	-	-	-	31,459
1908	-	14,532	14,532	-	20,153	20,153	-	-	-	34,685
1909	-	15,708	15,708	-	22,240	22,240	-	-	-	37,948
1910	-	16,226	16,226	-	23,864	23,864	-	-	-	40,090
1911	-	16,604	16,604	-	23,808	23,808	-	-	-	40,412
1912	-	17,446	17,446	-	23,752	23,752	-	-	-	41,198
1913	-	17,660	17,660	-	23,696	23,696	-	-	-	41,356
1914	-	18,595	18,595	-	23,640	23,640	-	-	-	42,235
1915	-	18,975	18,975	-	23,584	23,584	-	-	-	42,559
1916	-	19,441	19,441	-	23,528	23,528	-	-	-	42,969
1917	-	20,944	20,944	-	23,472	23,472	-	-	-	44,416
1918	22,197	4,827	26,984	23,415	4,957	28,372	-	-	-	55,356
1919	24,435	5,324	29,759	24,867	5,264	30, 131	-	-	-	59,890
1920	25,330	5,518	30,848	27,663	5,856	33,519	-	-	-	64,367
1921	26,292	5,728	32,020	28,968	6,132	35,100	-	-	-	67,120
1922	27,325	5,953	33,278	30,024	6,355	36,379	-	-	-	69,657
1923	31,322	6,824	38,146	33,438	7,078	40,516	-	-	-	78,662
1924	34,072	7,428	41,497	34,113	7,222	41,335	-	-	-	82,832
1925	34,801	8,199	43,000	35,208	7,692	42,900	-	-	-	85,900
1926	33,316	8,955	44,470	37,331	8,369	45,700	-	-	-	90,170
1927	41,410	9,990	51,600	34,460	8,140	42,600	-	-	-	94,200
1928	39,422	8,338	48,760	42,254	10,446	52,700	-	-	-	101,460
1929	43,564	9,886	53,480	42,232	10,968	53,200	-	-	-	106,680
1930	45,386	10,388	55,774	42,806	11,594	54,400	394	-	394	110,650
1931	44,014	10,557	54,571	41,803	11,837	53,640	3,273	236	3,499	115,710
1932	43,138	9,732	52,868	41,378	12,122	53,500	3,271	514	3,785	115,180
1933	43,468	9,371	52,839	40,859	12,441	53,300	3,897	514	3,911	116,050
1934	43,837	9,231	53,068	39,665	12,435	52,100	3,868	514	4,082	115,250
1935	43,641	8,998	52,639	39,380	12,820	52,200	4,016	548	4,564	113,800
1936	43,265	8,086	51,349	39,515	13,245	52,760	4,148	723	4,871	115,980
1937	51,369	8,077	59,446	40,062	13,738	53,800	5,181	723	5,904	119,150
1938	51,781	8,148	59,946	38,874	13,626	52,500	5,293	1,823	6,606	119,050
1939	53,641	8,066	61,707	39,573	14,127	53,700	5,467	1,628	7,095	122,500
1940	54,084	8,827	62,911	40,300	14,200	54,500	5,772	2,787	8,539	125,950
1941	57,502	9,010	66,512	41,858	13,178	55,036	6,075	3,980	10,055	131,611
1942	56,737	9,192	65,929	42,318	13,178	55,496	7,430	4,206	11,636	133,089
1943	57,526	10,728	68,256	42,451	13,178	55,629	9,154	5,648	14,797	138,682
1944	59,237	11,053	70,290	43,279	13,435	56,714	9,066	5,686	14,752	141,790

Source of Data

1879-1917 - All Data — Article by Walter M. Splawn in Oil and Gas Journal, September 22, 1938.

1918-19-20 - Lines reporting to I.C.C. (trunk and Gathering) from article by Walter M. Splawn in Oil & Gas Journal, September 22, 1938, page 54.

Lines not reporting to I.C.C. (trunk and gathering) estimated from percentage of I.C.C. lines shown in Petroleum Facts and Figures - 1941, for the year 1924.

1921-1923 - Lines reporting to I.C.C. (trunk and gathering) from I.C.C. Statement 4280.
Lines not reporting to I.C.C. (trunk and gathering) estimated from percentages from figures for 1924 of I.C.C. lines shown in Petroleum Facts and Figures for 1941.

1943-44 - All data partially estimated.

1924-1940 - Lines reporting to I.C.C.
Total Trunk } I.C.C. Statement No.
Crude Gathering } 4280, page 24.

Products lines developed from construction data and subtracted from total trunk lines, statement 4280 to get total crude trunk lines, reporting to I.C.C.

Grand total for trunk and gathering taken from Petroleum Facts and Figures, 1941.

Crude lines not reporting to I.C.C. obtained by subtraction.

1941-1942 - Lines reporting to I.C.C. from I.C.C. reports

Lines not reporting to I.C.C. partially estimated, Consideration given to Bureau of Mines Statement IC-7196

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PIPE-LINE SECTION
Reproductions of the Petroleum Industry War Council official pipe-line maps, showing crude-oil and products systems in the central and eastern states are on the inside of this folded insert. California is from E. G. Jacobson's map showing crude oil and gasoline pipe lines of the United States.

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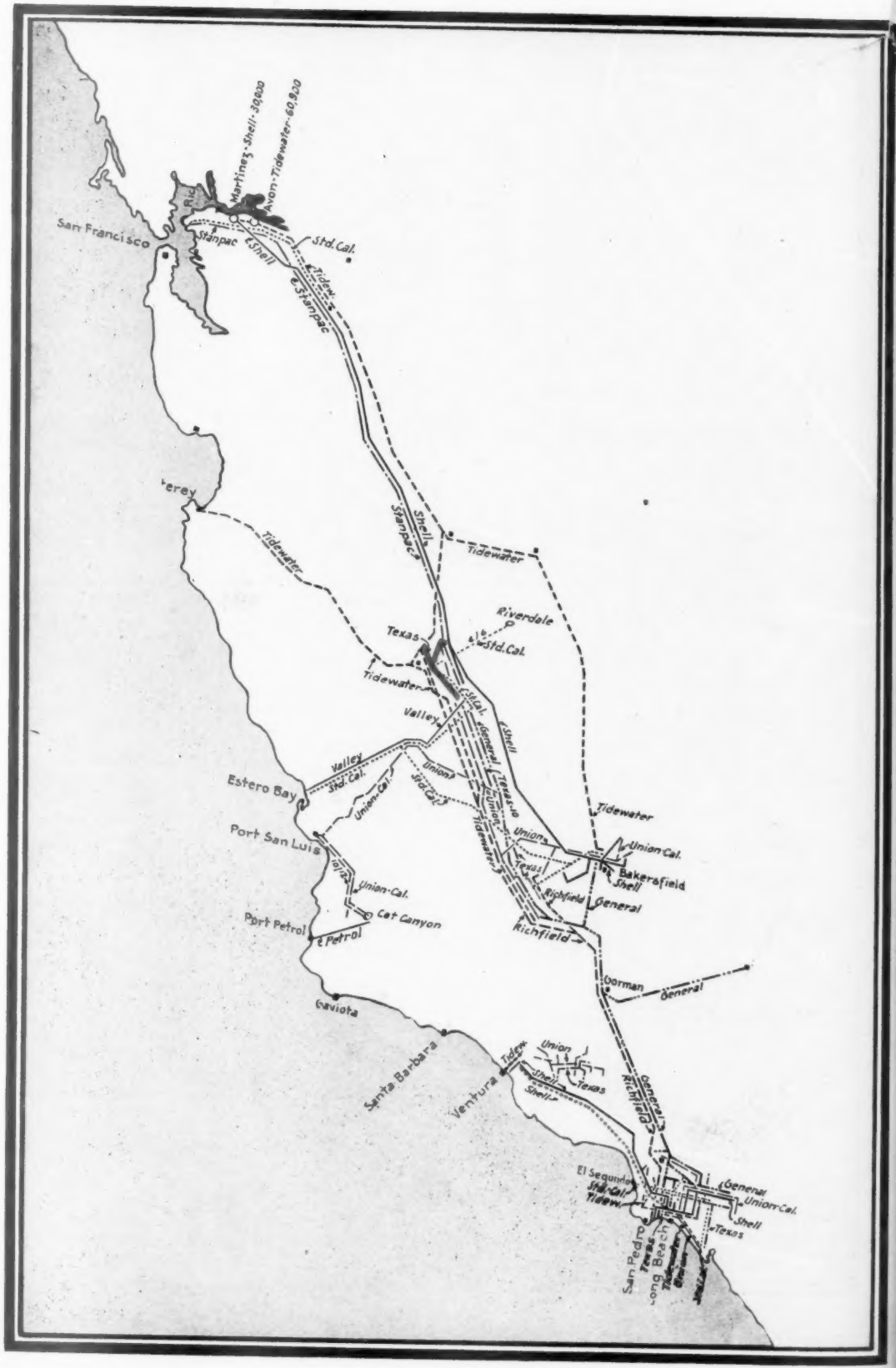
Martinez-Shell-30,000
Avon-Tidewater-60,900
Rich.
San Francisco
Stanpac
Shell
Std. Cal.
Tidew.
Stanpac
Shell
Stanpac
Tidewater
Tidewater
Riverdale
Texas
Std. Cal.
Tidewater
Valley
Shell
General
Valley
Std. Cal.
Union
Union Cal.
Std. Cal.
Estero Bay
Port San Luis
Union Cal.
Cat Canyon
Port Petrol
Petrol
Gaviota
Santa Barbara
Ventura
Tidew.
Union
Shell
Texas
Shell
Richfield
General
Tidewater
Union Cal.
Bakersfield
Shell
Richfield
General
Richfield
Gorman
General
El Segundo
Std. Cal.
Tidew.
General
Union Cal.
Shell
Texas
San Pedro
Long Beach

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The Possibilities of Pipe-Line Research

by W. R. Finney

THE atomic bomb has electrified the world and brought to the minds of millions the accomplishments of scientists and the results attainable through diligent research. This new discovery has brought a sudden end to the war, but man's creation should not be used solely for destruction. The same forces can be employed to keep the peace and to improve living conditions for countless thousands.

This objective can be reached through the proper use of new inventions in many ordinary ways. For example, more and better housing, required in many locations, should include all the latest improvements in lighting, heating, and air conditioning. Methods of food production, preserving, and storing are being continually advanced. Disease is being further controlled by new medicines and epidemics eliminated. Education continues on a broader scale. All these things lead to fuller understanding, better living, and more enjoyment.

In modern society the satisfaction of basic human needs —food, clothing, shelter, etc.— involves transportation in some form. Moving things from one place to another is a daily requirement, and the world-wide needs for transport reach a tremendous volume.

Modern transportation can be classified into automobiles, trucks, trains, waterways, and planes. All of these can use liquid fuel from petroleum. This creates a competitive situation where the cost of the transportation of fuel itself often determines the type of fuel to be used for moving freight of different kinds.

The movement of petroleum either in the crude state or as refined products through buried pipe lines has proven so dependable and satisfactory that the daily deliveries have increased continually. The use of pipe lines has been expanded rapidly by wartime requirements. In addition to the domestic pipe lines, which include the now famous War Emergency's Big and Little Inch, the military people have used portable pipe lines to great advantage in many for-

Finney's Career Covers Both Engineering and Management

WALLACE R. FINNEY, president of Interstate Oil Pipe Line Co. and pipe-line advisor, Standard Oil Co. (New Jersey), was born and raised on a ranch near Modesto, Calif., and graduated from Stanford University in mechanical engineering in 1912.

Work in a pipe-line gang for Standard Oil Co. of California in the San Joaquin Valley started his oil-field experience. Following this he was roustabout for Montebello Oil Co., Fillmore, Calif. During 3 years with this company, he gained practical experience as gasoline-plant operator, pipe fitter, and construction foreman. While in charge of the gas plant and while handling general oil-field work, he gained first-hand knowledge of pipe lines, pump stations, drilling, and production methods.

In May 1917, Finney went to Oklahoma where he spent a short time with the Empire companies at Bartlesville, designing and building natural-gasoline plants. He left to enter the employ of Midwest Refining Co., Casper, Wyo., July 1, 1918. After a few years of designing and constructing gasoline plants in Salt Creek and Elk Basin, he became superintendent of the gas department where he had experience with some of the first welded pipe lines ever built. In November 1923, Finney was advanced to general superintendent of the gas and electric department; he assisted with the design, construction, and operation of the Salt Creek electric plant, and he was concerned with various problems of electrifying producing oil fields. In March 1928, he become chief engineer of the field division in the Rocky Mountain area, supervising construction of several gas and oil pipe lines and handling

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eign countries. The Army pipe line is generally known as the invasion type, designating quick laying and portable pumping units all of which are easily reclaimable. These lines have delivered refined products to the fighting fronts throughout the world. They have resulted in the saving of many lives through having aviation gasolines at strategic points in sufficient quantities.

Public Pipe-Line Conscious

The success of the pipe lines in the progress of the war has made people pipe line conscious, and if the industry expects to maintain its position in the postwar transportation field, it must continue to improve its methods and lower costs. Much has been accomplished along these lines during the past generation, such as, the introduction of seamless and electric welded pipe, better steel and higher operating pressures. The efficiency of the internal combustion engines has been improving rapidly and with the adoption of air filters, fuel oil centrifuges, lube oil cleaners and closed engine cooling, the life of a diesel engine has been doubled. Pipe-line pumps are better built and more efficient with novel changes, such as, the variable stroke. Automatic temperature and pressure regulators have been applied and complete remote control of an entire pipe line seems just around the corner. Batching of different petroleum products through a single line without loss or harmful contamination is an every-day occurrence. In this field the use of an inhibitor to reduce internal corrosion of refined products lines has been a complete success. The biggest gain from inhibiting is larger volumes because of the smooth inside wall of pipe. Many other new improvements have been made in pipe line apparatus and equipment, and better methods of operation and advanced technique have been adopted. However, many intriguing possibilities appear just over the horizon.

A. Gasoline pipe lines need different filters to remove the rouge-like fine steel and rust sediment carried in the liquid stream. An adequate filter or the elimination of this nuisance by other methods would protect the delicate meter parts and prevent damage of valves, revolving pump shafts, and sliding parts.

B. Some inhibitor, admixture or diluent is needed for crude oil pipe lines to improve the pumpability, especially with viscous oils. The loss of capacity with heavy oils is especially damaging during the winter in cold countries.

C. External corrosion of steel pipe lines is still a problem. Various coatings and cathodic protection have been fairly successful. The latter, however, varies in results with changing seasons and wet and dry ground. The final answer may be alloy pipe or pipe with an outside surface made of rust-resisting steel. This same stainless metal might be used to line the inside walls of the pipe wherever corrosion is a factor. The extra cost of higher grade steel might be compensated for by lighter walls and higher pressures.

D. The gas turbine developed during the war may be the pipe line prime mover of the future. Its adoption will require adjustments to allow the use of crude oil as fuel for the turbine on black oil lines. It will also call for heat-resisting metal parts of the turbine.

The accomplishments that seem possible in the pipe line industry can only be attained through long and careful study, followed by well-planned investigations. It will call for delicate laboratory experiments followed by practical field tests. All of these fall under the term Research and Development. It is "research" while you are looking for something new and certainly means "development" if you can make a discovery. This type of work calls for special training and the best results can only be obtained with men of the proper education and temperament. Many good pipe line engineers seem clumsy in the laboratories while the research man is lost around the pipe line pump station.

These special requirements for technical men with a flair for searching into the unknown should offer an opportunity for some of those returning from the armed services. Many of these young scientists have been carefully trained by the Government in physics, mathematics, chemistry and allied sciences, such as, electricity, electronics, and radar. The basic study requirements and the handling of instruments and apparatus in the Army and Navy are excellent experience. This special scientific knowledge has been called for in flying, navigation and communications. It would seem likely that many of these young men are ideally suited for research and development work.

Some of the pipe-line companies have already started these programs and many of them will be in a position to undertake reasonable expenditures for research to improve their methods and techniques. This will require added personnel and seems a happy solution for men looking for new jobs, which should result in advantages to the employing company. Getting the right man back from the war and into the job he is best suited for is not a simple problem. It will call for a careful study of the man's qualifications and a full understanding of human

(Continued on page 312)

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general engineering problems for several departments.

On September 1, 1929, Finney was transferred to New York to handle Lago's electrification program in Lake Maracaibo, Venezuela, and he assisted in gas-plant and pipe-line problems of the production division of Pan American Petroleum & Transport Co. in Mexico and Venezuela. When the foreign properties of Pan American were acquired by Standard Oil Co. (New Jersey), Finney was transferred to the producing department of the Jersey company in May 1932, to handle production and transportation work in foreign countries.

On becoming president and director of Oklahoma Pipe Line Co. and vice president of Ajax Pipe Line Corp., July 1, 1936, he moved to Tulsa where he also was in an advisory capacity for Standard Oil Co. of Louisiana's pipe-line department.

On October 1, 1939, Finney moved back to New York as a member of the producing department of Standard Oil Co. of New Jersey, to coordinate operations of several domestic oil-transportation companies. He was president of Portland Pipe Line Co. during construction of the Portland-Montreal project and director of Plantation Pipe Line Co. when its product project was undertaken. In the fall of 1943, Finney was made a director of several of the gas-pipe-line companies in which Jersey has an interest. He acts as a contact man at Rockefeller Plaza for these operations.

In January 1944 the pipe-line work in the New York office was separated from the producing department and the Office of Pipe Line Advisor was created. Finney was given this assignment and serves in a consulting capacity to some 15 gas, gasoline, and oil pipe-line companies and acts in an advisory capacity on pipe-line matters for the directors of Standard Oil Co. His work covers routine operations as well as new pipe-line projects both in the domestic and foreign fields.

Finney is president and director of Interstate Oil Pipe Line Co., McKamie Gas Cleaning Co., and director of Colorado Interstate Gas Co., Plantation Pipe Line Co., and Portland Pipe Line Co. During the war period, Finney has served as chairman of the Temporary Joint Pipe Line Engineering Subcommittee which supervised design and construction of the War Emergency Pipelines, Inc., project. He has worked in a consulting capacity with several other government agencies in Washington on various projects.

Design of Station Piping for New Construction or Present Installations

by William J. Wilkins

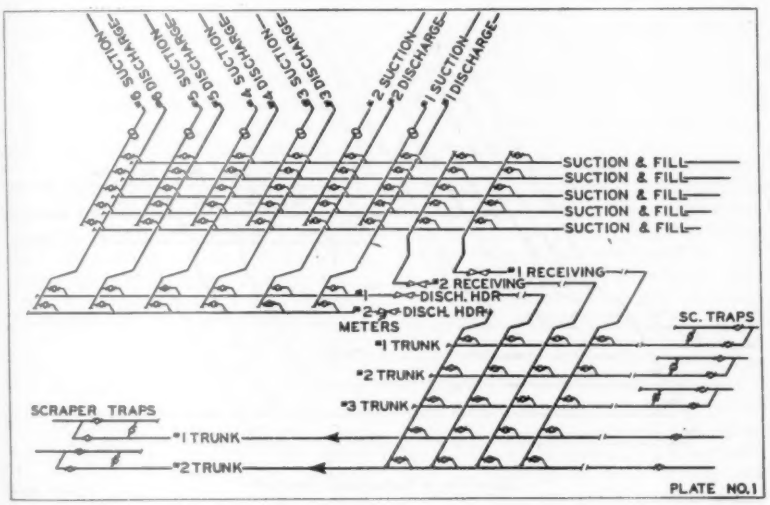
THIS article is devoted to a discussion of pump-station piping which may be applicable to new construction on present installations, or to new systems under construction or consideration. Several types of installations to satisfy the pumping requirements will be illustrated and discussed.

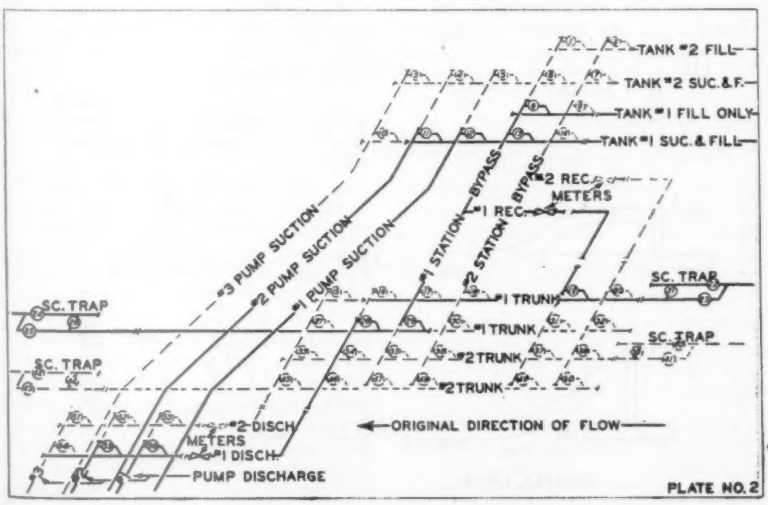
Plate 1 illustrates a piping system for a six-unit reciprocating pump station serving five trunk lines. It is recognized that the trend in pipeline design is toward construction of single trunk lines of large diameter, but we are still confronted with the fact that a large percentage of the crude-oil pipe-line capacity in existence consists of parallel lines of relatively small diameter.

The plan shown is for a trunk-line-station check point at which pumpings are receipted by alternate filling and emptying of the five tanks indicated. The arrangement of the receiving lines is such that two grades of crude can be received simultaneously from any line or lines from either direction. Also, the arrangement of the discharge lines is such that two grades can be pumped into any combination of lines.

One of the most important factors to be considered in designing a station piping system is provision for future expansion of the system without being forced to resort to extensive rearrangement of the facilities originally installed. There are several basic features that can be incorporated in the original design to permit expansion of the system when required. It will be noted that the trunk lines are not continuous. This permits the construction of top cross headers to receive from either direction or discharge in a similar manner. Even in the construction of a single line it will be prudent for the designer to bear this in mind and plan the layout so that subsequent construction of additional trunk lines will not complicate the setup, but will permit connection into the original system merely by extending the receiving or discharge headers. In like manner, all pump discharge and suction headers are constructed to permit connection into additional tank lines or discharge lines. Failure to provide for additions to a manifold will result in expensive revamping of the original arrangement or construction of makeshift connections which may in time become so cumbersome and unwieldy that the situation becomes intolerable, thereby necessitating a major construction change.

In planning any system, the designer should provide for sufficient space to permit the construction of additional trunk lines, discharge lines, or suction and filling lines.





William J. Wilkins, chief engineer, Tulsa Pipe Line Division, Gulf Refining Co., was born in Steubenville, Ohio. He graduated from University of Pittsburgh in 1926, with the degree of petroleum engineer. During vacations he had worked for Marland Oil Co., and joined this company upon graduation, as assistant petroleum engineer, at Ponca City, Okla. Later he was transferred to West Texas as division engineer. He joined the Gulf organization in 1929 as mechanical engineer, and 10 years later was appointed to his present position.

This can be done while still retaining the desirable feature of compact valve arrangement. The diagram illustrates this provision for additions.

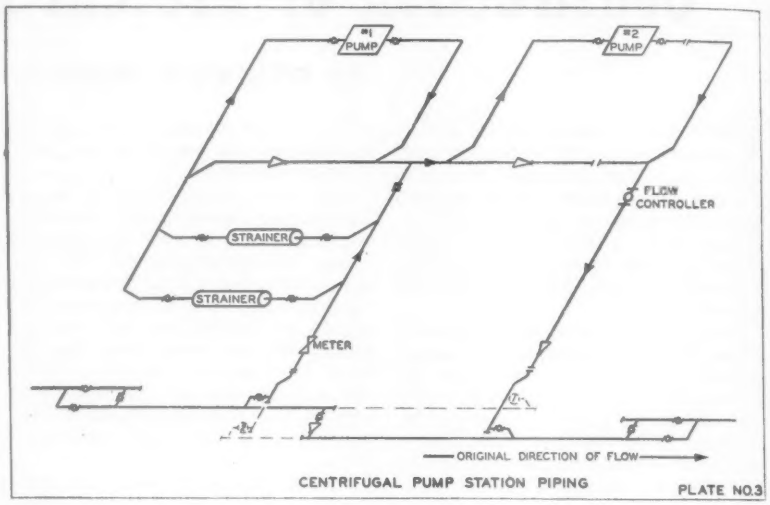
A feature of the piping shown worthy of mention is the location of the meters on the discharge and receiving lines. This arrangement provides for metering incoming and discharge streams, regardless of the direction of trunk-line flow. No reversing or alteration of the meter tubes is necessary.

Venturi-Type Meters

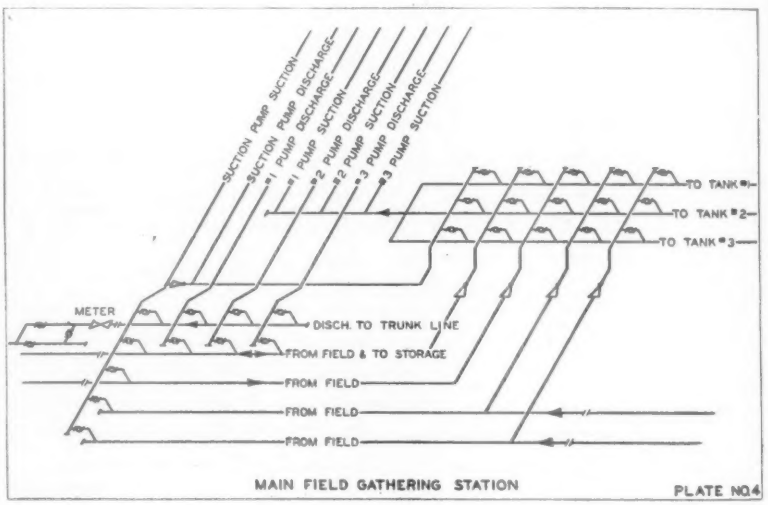
Although the subject of metering lies outside the scope of this article, a brief mention of the venturi-type meters in use may be of interest. These meters indicate and record the rate of flow with cumulative pumpings recorded on an integrator. While cumulative pumpings are of value, the author is of the opinion that the most valuable feature of a meter in trunk-line service is a recording of the rate of flow. This is invaluable to the pump-station operator and the oil dispatcher, especially on the discharge side. With no change in operating conditions, a decrease in rate of flow with a corresponding drop in discharge pressure indicates some mechanical difficulty in the station pumps. If the rate of flow remains constant while the discharge pressure drops, a line failure of some sort has occurred. The use of a meter on each individual trunk line in discharge service will prove to be of great value in determining the particular line on which a leak has occurred. The objection may be raised that the pumping equipment cannot be divided to take advantage of maximum line capacity. This is a false premise as reference to the piping diagram will prove. If the stream is being pumped through two trunk lines in the direction indicated by the arrow on the diagram, all 12 valves from the pump discharge lines into the two discharge headers can be in open position. The line capacities will adjust themselves to the discharge pressure with the rate of flow indicated on the charts of the two meters. Any decrease in pressure caused by a line failure will result in an increased rate of flow into the line which has failed. The rate of flow in the sound line will decrease. This segregates the source of trouble and permits operation of the other lines in the system while the leak is being located. There is no choice except to operate the discharge headers independently if two grades of crude are being pumped simultaneously.

Plate 1 is an actual diagram of a piping system recently completed at a trunk-line pumping station. The history of this station will justify the flexibility provided for in the design. When originally constructed, the station received from the north and pumped south through one line. Later a second line was added, while operations were continued in the same manner. During this period two grades were pumped south. Still later another line, since lifted, was laid into the station from another source, and three grades were pumped south through three trunk

(Continued on page 311)



CENTRIFUGAL PUMP STATION PIPING PLATE NO.3



MAIN FIELD GATHERING STATION PLATE NO.4

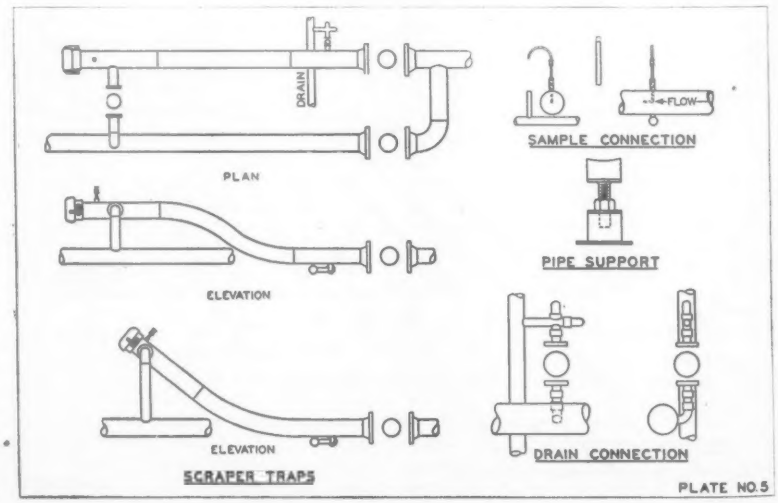


PLATE NO.5

Pumping Various Products Through The Same Pipe-Line System

by J. M. Williams

J. M. Williams was loaned by The Atlantic Refining Co., for the duration of the emergency, to operate the War Emergency system in the capacity of vice president-manager of operations. After graduation from Vanderbilt University he took post graduate work at Centenary and University of Chicago. He became associated with Atlantic late in 1924. In 1931 he went east to assist with the construction of Atlantic Refining's Keystone products distribution system. After completing the installation of this project, he was retained in the east to operate this system, which grew from a 226-mile beginning to the integrated system which has pioneered so many products line developments. In the preparation of this article, the theory presented answers some questions which have puzzled pipe-line operators and the development of which has permitted increased use of pipe lines for distribution of refined petroleum products.

WHEN the first products pipe lines were built in the late 1920's and early 1930's, some new operating problems were created. The products pipe line differed somewhat from the older, crude-oil lines. For one thing they differed in operation in that in the crude-oil system a through movement was the rule, usually from the field to either a refinery or a deep-water terminal. Products lines, on the other hand, originated at a refinery (the route of the line being through the sales area it served) with a reduction in throughput as the length of the line increased from its origin, due to the products of the refinery being dropped off at strategically located terminals along the route of the line.

Products lines introduced new angles in hydraulic design, pumping equipment, terminal facilities and the like, and with the demand for two or more grades of gasoline and the increased use of household heating oil, an entirely new problem was created. Obviously, the company that was in a position to use the same pipe-line transportation facilities for pumping these various products was in an advantageous position. Also, a company operating a products pipe line and possessing the technical skill to transport these various products would be in a position to seek new business from other refiners serving the same areas. The transportation revenue resulting from the increased use of the lines would obviously reduce the cost of operation to the company which owned the pipe lines and could even help to amortize the original cost of the lines.

Early in 1932, experimental work was done by Keystone Pipeline engineers, working toward a fuller use of their existing gasoline line and by the fall of that year, sustained movements of two different kinds of gasoline, as well as kerosene and furnace oil were being shipped through their Pennsylvania facilities.

Shortly thereafter other companies who marketed in the area served by the pipe line began to use the Keystone system, so that by 1940 eight grades of gasoline, two grades of kerosene, two grades of furnace oil and one grade of gas oil were being pumped. Twenty-four grades of products have been pumped for seven different shippers, with each grade individually delivered to the various terminal points. All of these products are pumped completely ready for use.

Since that time, the results of the Keystone engineers' experiments have been shared with other companies and more recently, the information was made available for use by War Emergency Pipelines. The same principles developed in 1932 have been applied to War Emergency Pipelines operation, the results of which most everyone in the oil industry is familiar with.

Such a considerable amount of interest has been displayed regarding the problems involved, that we propose to discuss in this article the theory involved and the results obtained in transporting a wide range of products through the same trunk-line system.

Theory

In 1883 Prof. Osborne Reynolds performed a series of experiments in connection with the flow of water through pipes. By introducing colored liquids into the stream he observed that under certain conditions, the flow was streamline in character at low velocities and turbulent at greater velocities.

From the study of the equations of fluid motion, Reynolds determined that the character of the motion depended upon the expression

$$\text{(A)} \qquad \frac{D v \delta}{\mu}$$

in which

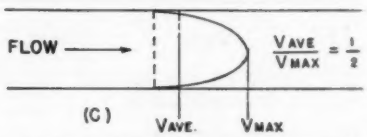
D = Pipe diameter
v = Velocity of the fluid
δ = Density of the fluid
μ = Viscosity of the fluid

and that the change from streamline to turbulent motion took place when

$$\text{(B)} \qquad \frac{D v \delta}{\mu} = 2{,}000 \text{ to } 2{,}500$$

This expression is referred to as Reynolds' Criterion or Reynolds' Number.

Streamline flow.—Liquids have a tendency to adhere to the metal pipe surface as they are flowing through a pipe line. On account of this tendency, the outermost cylinder of liquid in a pipe moves, but very slowly. Each succeeding cylinder may be regarded as sliding over its neighbor like an unfolding telescope or a collapsible drinking cup. The velocity with which each cylinder moves through the pipe increases from the wall toward the center, so that a traverse of velocity taken with a pitot tube across the diameter of pipe would look like Plate C.



During streamline flow, the ratio of the mean velocity over the maximum velocity (which usually occurs at the center) is equal to one-half.

Turbulent flow.—If the rate of flow be increased to a point where

XUM

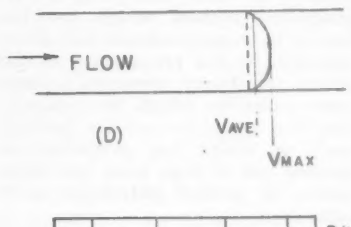
the velocity reaches the value so as to make

$$\frac{D v \delta}{\mu} = 2{,}000 \text{ to } 2{,}500$$

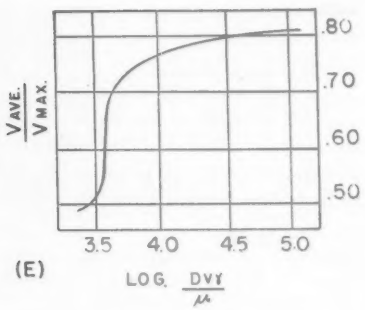
the velocity is said to have reached its critical value. A sudden change takes place in the character of the flow from a streamline flow into a swirling or eddying motion. The ratio

$$\frac{\text{V average}}{\text{V maximum}}$$

rises at once to 0.7 and increases to 0.82 for turbulent flow. (See Plates D and E).



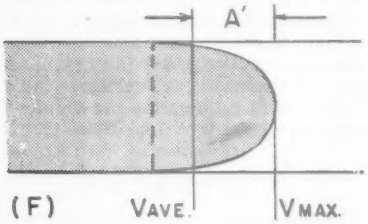
(D)



(E)

Contamination

Now then, for purposes of consideration, let us suppose two liquids of like character, but colored differently, as flowing in a pipe. If the two liquids be colored gray and white and the white introduced into the pipe first, the instant the liquids are in contact the gray liquid will begin to pierce the white liquid, and A′ (Plate F) which represents



(F)

the length of the piercing effect, will be proportional to

$$\text{(G)} \qquad \frac{D v \delta}{\mu}$$

Since the liquids are the same, except for color, and the pipe a constant diameter, A′ is directly proportional to the velocity. (See Plate E). The length A′ can easily be determined from

$$\text{(H)} \qquad \frac{\text{V average}}{\text{V maximum}} \qquad \text{(See Plate E)}$$

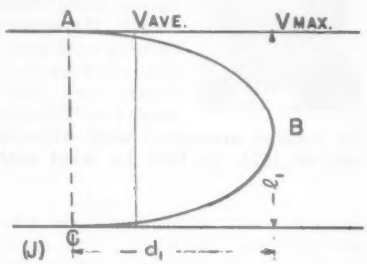
and the gray liquid will contaminate the white liquid for a length equal to

$$\text{(I)} \quad C = (\text{V maximum} - \text{V average})\ t$$

where

C = Length of contamination stream in feet
t = Length of time liquid is flowing in the pipe.

This then, defines the length of the contamination stream. Now, let us consider what actually happens in the pipe during the time this contamination is taking place. (See Plate J).



(J)

The shape of the curve ABC has been shown to be parabolic in shape and its area is consequently equal to

$$\text{(K)} \qquad A = \tfrac{2}{3}\, l\, d$$

where

l = latus rectum of parabola
d = length

also, the ratio of the mixture of the liquids will be equal to

$$\text{(L)} \qquad \%\ C = \frac{\tfrac{2}{3}\, l\, d}{l_1\ d_1} \times d_1$$

= area of rectangle $l_1\ d_1$.

Since the diameter of the pipe and the latus rectum of the parabola are equal

$$\%\ C = \tfrac{2}{3}$$

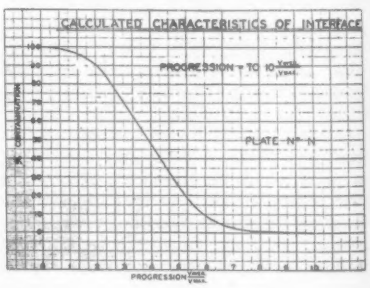
This is not strictly true since V average does not occur at the latus rectum of the parabola. (See Plate J). However, the effect of this will be to change the value of V maximum and the value of % C and probably to lower the ⅔ figure mentioned previously.

Now, let us watch the red liquid progress into the white liquid at a speed (V maximum — V average). We will divide it into a series of progressions of a length 10 and observe the portion contaminated at the end of each stage in the progression. (See Plate M).

Assuming the piercing volume to be 66 per cent, then at the end of the first progression, there is 34 per cent white in the mixture; this 34 per cent white is further contaminated by 66 per cent of pure material so that 11.56 per cent white is in the mixture at the next progression and so on.

When these values of percentage contamination are plotted against the series of progressions, an observer stationed at "A" and drawing and analyzing samples as the contamination approached him, would observe an interface between the liquids which would have the appearance of Plate N.

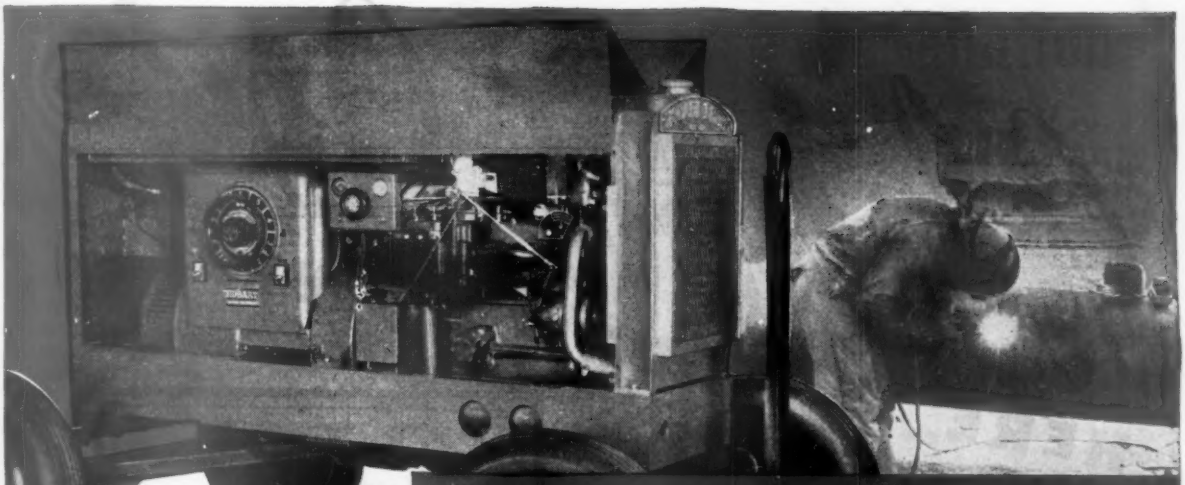
(Continued on page 308)



CALCULATED CONTAMINATION FOR A PROGRESSION = 10 $\frac{V_{AVE}}{V_{MAX}}$

	1	2	3	4	5	6	7	8	9	10
1	.34									
2	.115	.564								
3	.039	.268	.712							
4	.013	.1189	.419	.81						
5	.0045	.0485	.214	.552	.875					
6	.0015	.0194	.106	.332	.661	.917				
7	.0005	.0075	.049	.183	.445	.748	.954			
8	.00018	.0028	.021	.094	.318	.547	.815	.954		
9	.00006	.0011	.009	.038	.1702	.395	.638	.865	.9782	
10	.00002	.0004	.0049	.025	.095	.248	.488	.7159	.9034	.954

PLATE \ NO. M



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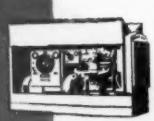

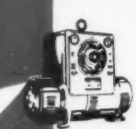

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THE SYSTEM OF SCIENTIFIC WATER TREATMENT
FOR THE PETROLEUM INDUSTRY

Technique for Determining Installation Of Cathodic Units

by O. C. Mudd

METHODS applied for determining the correct distribution of cathodic-unit installations are presented in this article as well as a discusion of policies governing the installation of insulating flanges.

Practices described have been developed in a program for corrosion mitigation in which cathodic and galvanic protection units have been progressively installed over the Shell Pipe Line Corp. system until many sections previously requiring excessive maintenance work are now reasonably free from leaks. This program has been steadily carried on since studies of pipe-line corrosion were initiated by the company as early as May 1933.

Determining Distribution

Along a pipe line the proper locations for direct-current cathodic-protection units of a specified current capacity (usually 40 amp. at 10 volts on a 10-in. line) must be determined by tests with equivalent currents from two portable engine-driven generators made at trial groundbed installations. These test generators should be able to develop a higher voltage than that of permanent units so as to allow the use of low-cost test groundbeds of higher resistance than permanent ones. Test units used by Shell Pipe Line are 2.5-kw., 50-amp., 50-volt (nameplate rating) generators driven by four-cylinder gasoline engines and mounted on pneumatic-tired two-wheel trailers. These generators will deliver 75 amp. with a corresponding decrease in voltage.

Temporary groundbeds are prepared 300 to 400 ft. away from the pipe line by boring 8 or 10 2-in. auger holes 4 or 5 ft. deep in the lowest-resistivity soil that can be located. Single anodes of 1-in. junk steel pipe of sufficient length to project above ground are inserted into these holes, after which salt and water are added around them. Copper cables from the generator test unit are then connected, one from the negative terminal to the pipe line and one from the positive terminal to each of the inserted pipe anodes. After the generator is started, the number of the latter can be increased as required until the desired total current flow into the soil is obtained.

The first generator unit is connected to the pipe line and test groundbed at one end of the line section along which cathodic protection is proposed. This unit then is operated at the desired current output for 4 to 5 hours to polarize the adjacent pipe surface. With the unit continuing in operation, pipe-to-soil potential measurements then are taken by the copper-sulfate half-cell electrode method every 200 or 300 ft. along the line, starting near the unit connection and progressing away from it. These progressive measurements of potential are continued until it is found to be less than 0.25 volts (0.80 volts with copper sulfate electrode) negative to soil (the minimum for effective protection). Such measurements are continued beyond the point of minimum requirement to make sure of having passed the limit of effective protection. (Note: If previous surveys showed that natural pipe-to-soil potentials along certain portions of the section under test were such as to cause local current flow from soil to pipe—i.e., cathodic—it will be necessary to check the new values and polarity of the artificially impressed test potentials only along those portions which had tested anodic.)

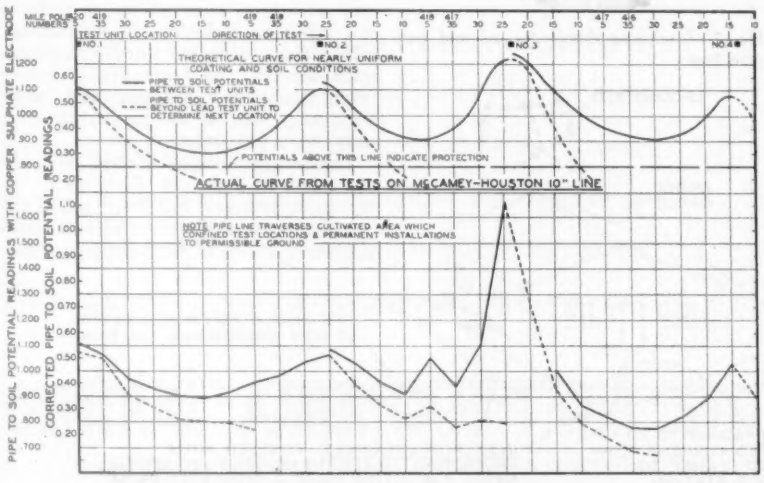
MILE POST NUMBERS
TEST UNIT LOCATION
DIRECTION OF TEST
NO. 1
NO. 2
NO. 3
NO. 4
THEORETICAL CURVE FOR NEARLY UNIFORM COATING AND SOIL CONDITIONS
PIPE TO SOIL POTENTIALS BETWEEN TEST UNITS
PIPE TO SOIL POTENTIALS BEYOND LEAD TEST UNIT TO DETERMINE NEXT LOCATION
POTENTIALS ABOVE THIS LINE INDICATE PROTECTION
ACTUAL CURVE FROM TESTS ON McCAMEY–HOUSTON 10" LINE
NOTE PIPE LINE TRAVERSES CULTIVATED AREA WHICH CONFINED TEST LOCATIONS & PERMANENT INSTALLATIONS TO PERMISSIBLE GROUND
PIPE TO SOIL POTENTIAL READINGS WITH COPPER SULPHATE ELECTRODE
CORRECTED PIPE TO SOIL POTENTIAL READINGS

Fig. 1—Theoretical and actual curves of pipe-to-soil potential measurements for determining distribution of cathodic units

The second unit is connected to the pipe line and to a second temporary groundbed at a distance from the first unit approximately three times the length of line found under the effective protection (0.25 volts minimum) of the first unit. Both units are then operated simultaneously for the polarization period (4 to 5 hours). With both units continuing in operation, the pipe-to-soil potential measurements then are taken from generator to generator to find if protection is complete. Insufficient protection between units requires moving the second unit and its groundbed nearer to the first location, and repeating the test. Overprotection requires extension of the distance between them, and repeating the test. Overprotection not only is uneconomical but also may damage the pipe coating; 2.5 volts is the maximum pipe-to-soil potential permissible—even near units.

After an intervening section is found to be satisfactorily protected, the measurements are continued be-

O. C. Mudd was born September 18, 1894, at Butte, Mont., and grew up on a cattle ranch near there, attending public school in Dillon, preparatory school at Billings Polytechnic Institute, and entered Montana State College at Bozeman to study electrical engineering. In 1928 he accepted a position with Shell at the Wood River refinery and was transferred to Shell Pipe Line during 1933 to assist in the first organized corrosion investigation on its system. He has continued in this work and is now chief corrosion engineer.

yond the second unit to determine a third location to which the first unit and groundbed should be transferred, and the above-described procedure repeated until the entire section of pipe line to be protected has been covered and the number of permanent unit locations determined. Fig. 1 shows graphically the theoretical and actual curves of pipe-to-soil potentials for satisfactory protection between successive test units and the determination of appropriate final unit locations.

The required spacing between these locations has been found to vary greatly. On a bare or uncoated 10-in. pipe line in the low-resistivity soil of East Texas, effective protection would require 40-amp. cathodic units to be spaced an average of about every 750 ft. Such a close spacing of these expensive installations is economically impractical, and the indicated solution required that the bare pipe should be coated as well as cathodically protected. The other extreme of required spacing was found on the 10-in. Bayou pipe line where a single rectifier unit with only 3 amp. output provided complete protection along 45 miles of heavy-type mastic-coated pipe laid through swampy lands. One unit with 5 amp. output amply protected an equal length of this line coated with coal-tar primer and coal-tar enamel and laid in soil equivalent to that of East Texas.

Pipe-to-soil potentials taken during tests along a bare or poorly-coated pipe line will be erratic—varying according to the variations of soil resistivity along the line. Such potentials along well-coated lines, due to the high resistance of the coating materials, will be nearly uniform, with only a slight gradient away from the point of current supply. Any local depressions of potential along coated lines are indicative of coating failure.

The above discussion of spacing referred to "cathodic units"; however, to determine the proper distribution of "galvanic anodes", a different procedure must be followed. Whereas generator or rectifier units may afford protection to an entire length of line, galvanic anodes are effective to protect only isolated corrosive sections. Enough such anodes must be installed in the local area so that measurements made with two copper-sulfate half-cell electrodes (one placed directly above the pipe and the other about 5 ft. away at right angles to the line) will indicate a definite current flow from soil to pipe along the local section to be protected. The latter criterion must serve instead of the 0.25-volt minimum used for generator or rectifier protection, inasmuch as galvanic anodes will not normally establish voltages of that magnitude even though satisfactory protection is being given.

Pipe lines can be sectionalized electrically to control current flows of either galvanic or external origin. Usually this is done by inserting "insulating flanges", as illustrated in Fig. 2, or equivalent insulated connections.

Pipe surfaces on each side of such insulating flanges should be protected from contact with soil for at least 50 pipe diameters in order to prevent concentrated flow of current from section to section around the insulation. This protection is obtained most effectively by placing the pipe above ground on suitable supports; however, where such a plan is impracticable, an effective alternative is to apply extra-thick bitumen coating (free of imperfections) along the requisite length of pipe, and to completely encase the insulating flanges in the same coating material. A second but less certain alternative is to bury the requisite length of pipe in clean, well-drained sand.

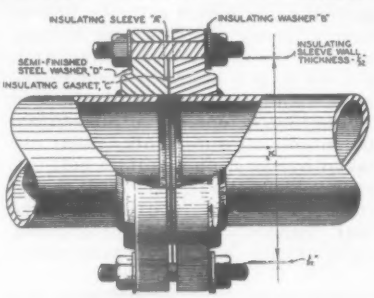

Fig. 2—Insulating flange for oil and gas pipe line

The insulation of pump stations from main pipe lines is always desirable in order to prevent rapid deterioration of buried station piping or structures which may be anodic to the main line. It becomes necessary, however, where a cathodic protection unit is installed at a station to provide protection for the line to adjacent stations. Near the unit the pipe-to-soil potential on the main line must be relatively high to force the current to intermediate and extreme points for entry into the pipe and flow back to the station. These high potentials will cause prohibitive current flows to station manifolds and structures unless the latter are properly insulated. Such structures may include buried service tanks, float and stock tank bottoms, buried conduits, deep-well casings and uncoated pipes.

To insulate such a station, insulating flanges are placed in the main line on each side of the manifold piping. The negative terminal of the cathodic unit is connected to the remote side of each of these insulating flanges. Protection of buried station structures can be provided by installing across one insulating flange a shunt of sufficient resistance to conduct only the current flow required for station protection: i.e., enough to establish 0.25 volts structure-to-soil potential. Fig. 3 illustrates such flange and shunt installations for a pump station.

Insulating flanges often can be installed advantageously along lines and at lateral connections to reduce corrosion by isolating the remaining pipe from extensive anodic sections such as tank bottoms, river crossings, gathering systems, and new pipe loops laid in the same right-of-way with old lines.

Insulating flanges should not be installed in existing lines until a complete analysis has been made of present current flow conditions and probable effect of such installations.

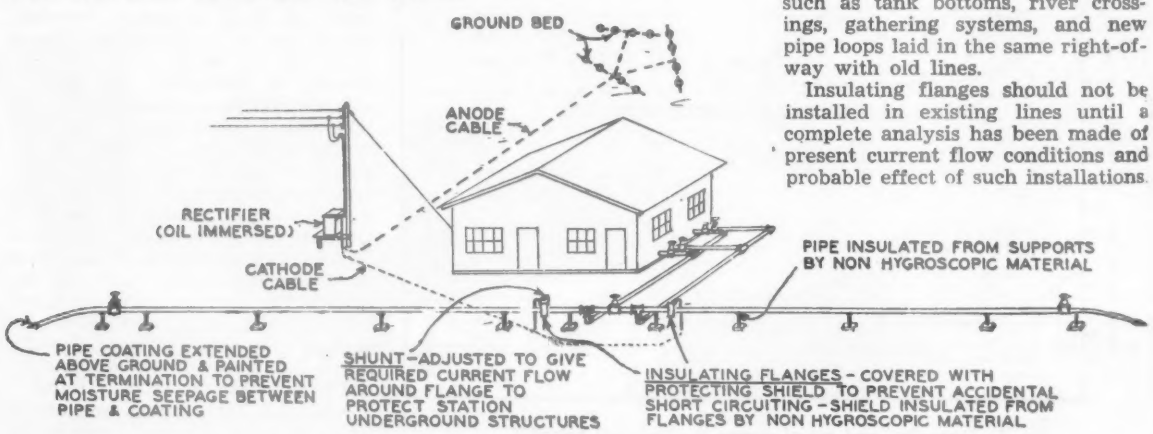
GROUND BED
ANODE CABLE
RECTIFIER (OIL IMMERSED)
CATHODE CABLE
PIPE INSULATED FROM SUPPORTS BY NON HYGROSCOPIC MATERIAL
PIPE COATING EXTENDED ABOVE GROUND & PAINTED AT TERMINATION TO PREVENT MOISTURE SEEPAGE BETWEEN PIPE & COATING
SHUNT—ADJUSTED TO GIVE REQUIRED CURRENT FLOW AROUND FLANGE TO PROTECT STATION UNDERGROUND STRUCTURES
INSULATING FLANGES—COVERED WITH PROTECTING SHIELD TO PREVENT ACCIDENTAL SHORT CIRCUITING—SHIELD INSULATED FROM FLANGES BY NON HYGROSCOPIC MATERIAL

Fig. 3—Typical insulating flange installation above ground at pump station of Bayou system where cathodic unit is installed

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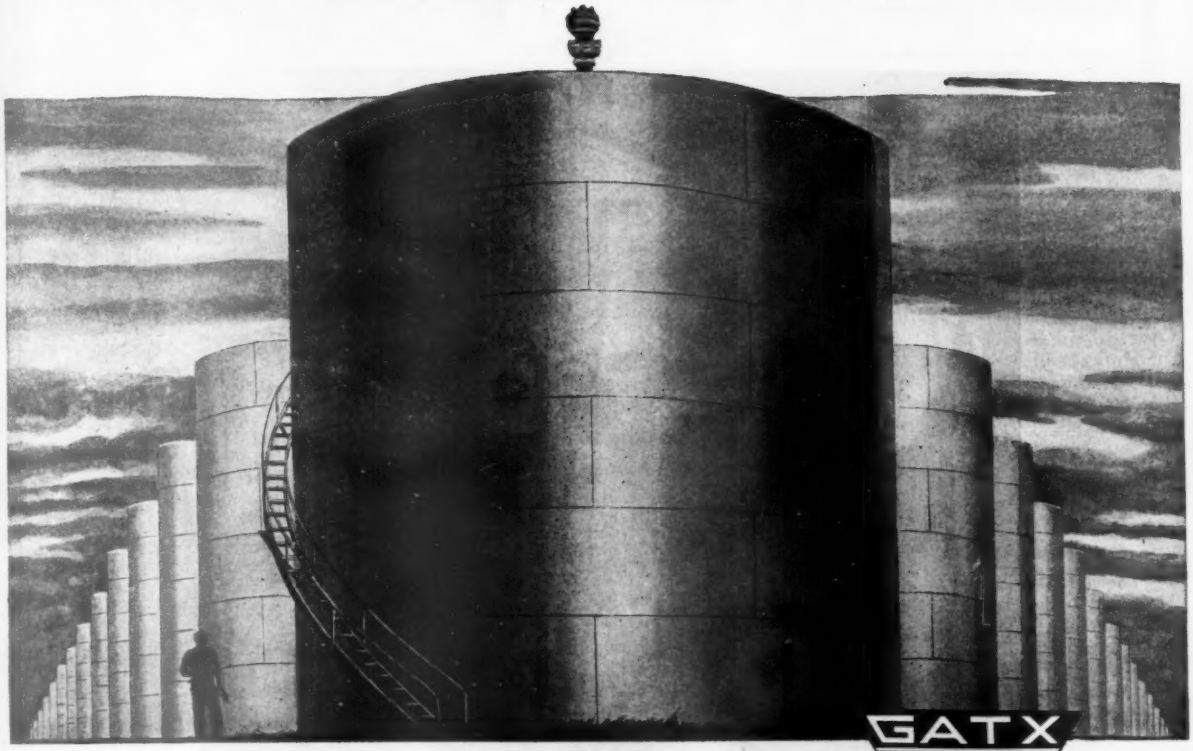

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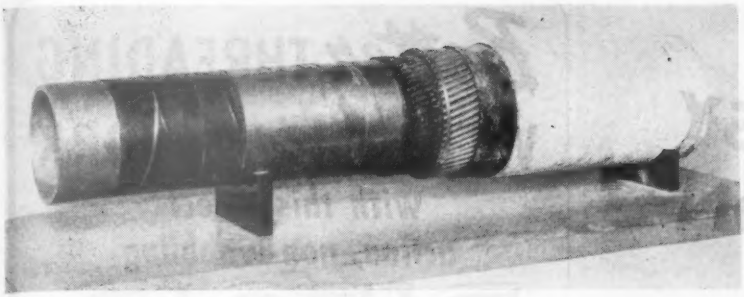

Fig. 1—Three-inch HAIS fuel pipe cable for English Channel

High-Pressure Gasoline Cable-Type Pipe Lines Under the English Channel

by V. A. Sheals

THE supply of material to the armies of the United Nations was probably the most difficult problem encountered in the invasion of Europe. Among the many items, fuel was of the utmost importance to keep the planes, trucks, tanks, flame throwers, jeeps, and many other forms of mechanized transportation and weapons in action. In 1942 the oil tankers, plying the English Channel and tied up in harbors, were "sitting ducks" for the German Luftwaffe. They were, however, the only means of transporting fuel at that time.

During a demonstration of flame throwers, Geoffrey Lloyd, British Minister of Petroleum Warfare, according to reports, asked Adm. Lord Louis Mountbatten whether anything more could be done by his ministry to assist in the coming invasion. Mountbatten is said to have replied, "Yes, can you lay an oil pipe line across the Channel?" This was in April 1942.

When seriously considered, most of the British engineers thought the job was impossible. However, A. C. Hartley, chief engineer of Anglo-Iranian Oil Co., conceived the idea of making a pipe-like submarine power cable omitting, of course, the insulation and conductors. Cable had been built to withstand an internal pressure of 200 lb. and the same principles, it was decided, could be applied to a higher-pressure pipe.

A cable-type pipe was designed and built by the cable firm of Siemens and an experimental 2-in. line installed in Bristol Channel in December 1942. It became known as HAIS for Hartley - Anglo - Iranian-Siemens.

U. S. Aid Enlisted

Several British cable manufacturers started to build the 3-in. pipe line in 1943 in anticipation of D-Day. These plants, however, were in vulnerable locations along the Thames Estuary, and bombs from the Luftwaffe dropped uncomfortably close to them. The project was so important it was decided that part of the pipe line should be manufactured in the United States and Hartley came to this country and enlisted the aid of the Corps of Engineers of the U. S. Army. Col. A. K. Eaton was given charge of the project for the U. S. Army Engineers.

Meetings were held with representatives of the principal American power-cable manufacturers in the early part of March 1944, and four manufacturers with the best facilities were selected to do the job. General Electric received its contract for 20 nautical miles (121,600 ft.) of the pipe cable March 30, 1944, and immediately started work

Upon graduating from Union College in electrical engineering in 1921, Vincent A. Sheals joined General Electric Co.'s test course, and in 1923 was transferred to the general office as a cable engineer. He has been very active in the development of both oil-filled and gas-filled cable. In 1927-1929 he was engaged in the installation of the first oil-filled cable used in New York and Chicago. Upon completion of this work, he was transferred to the New York office and in 1930 was appointed district cable specialist, a position he held until 1939 when he returned to Schenectady. He worked as assistant designing engineer of the company's cable engineering division until 1944 when he was appointed designing engineer, a position he now holds.

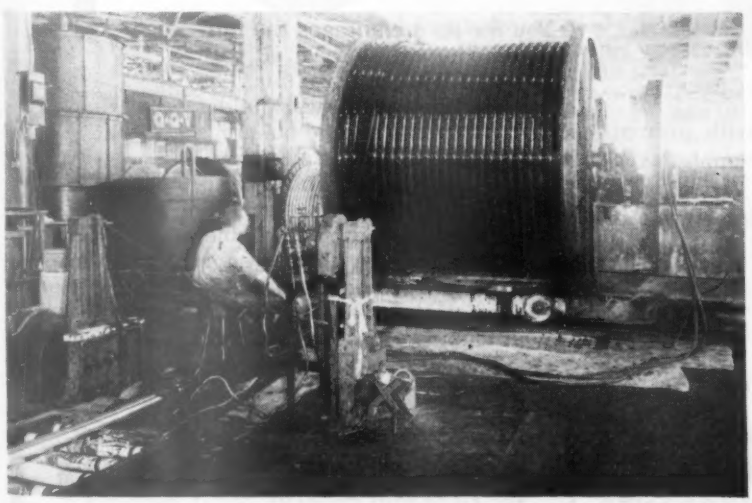

Fig. 2—Reeling of lead pipe from lead press

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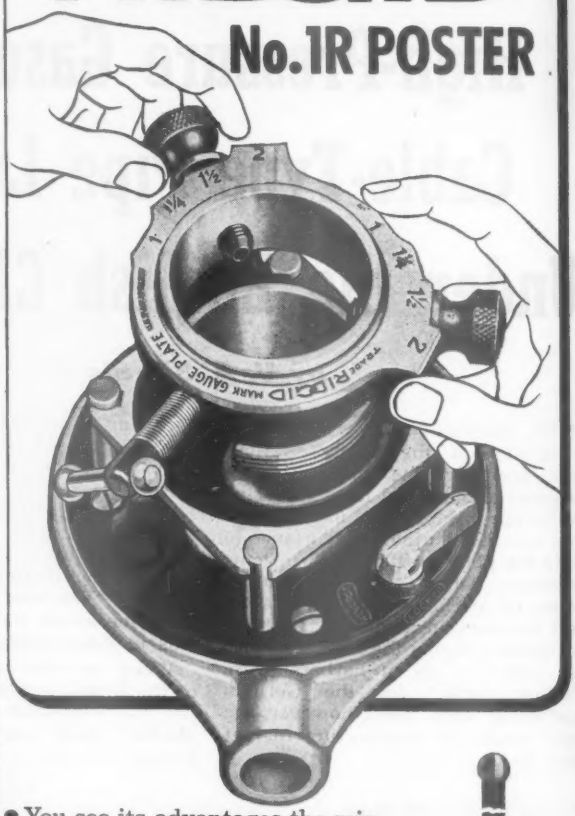

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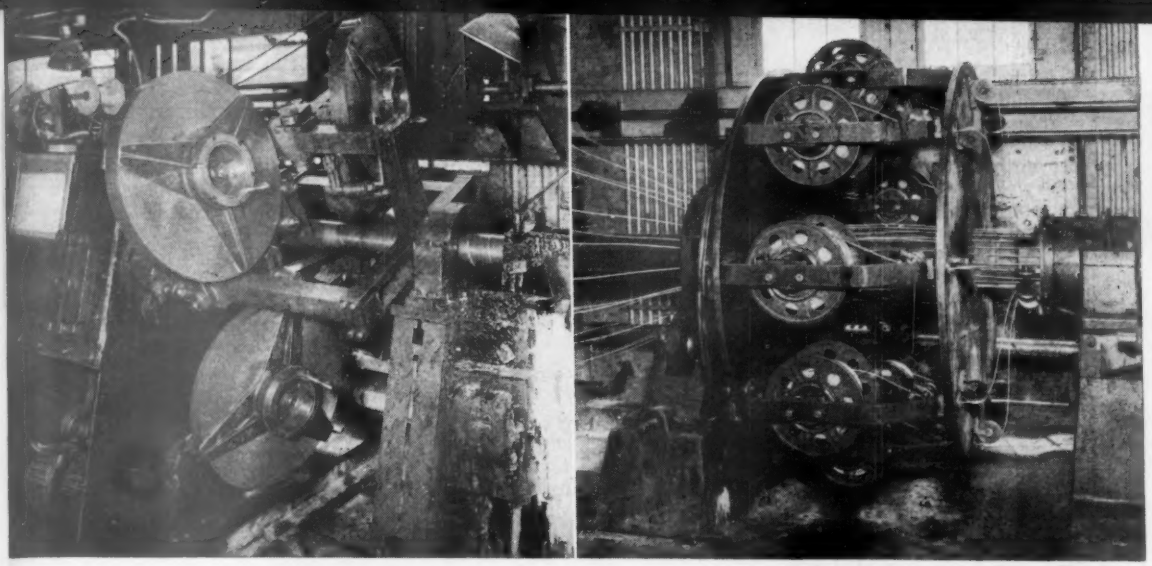

Fig. 3—(Left) Taping head applying four layers of steel tape. Fig. 4—(Right) Special nine-bobbin armoring cage increased total number of wires from 48 to 57

on the difficult manufacturing job required.

The design of the cable is shown in Fig. 1. The pipe itself of extruded lead, has a 3.05-in. i.d. with a wall thickness of about 0.190 in. The outside diameter of the finished cable is 4.6 in. and it weighs slightly more than 20 lb. per foot. An alloy of lead containing 0.06 per cent copper and 2 per cent tin was chosen in preference to the British Post Office alloy of lead, antimony, and tin. The lead pipe was extruded in 2,300-ft. lengths on special large-diameter reels. It was coated with an asphalt compound to prevent chafing and sticking together between turns and layers. A long series of guide rollers and a traversing-type reeling equipment were used to move the reel from side to side. This prevented kinking and flattening of the pipe and eliminated excess handling. The reeling operation of the pipe from the lead press is shown in Fig. 2.

Practically every one of the numerous operations on the assembly line required either new equipment or changes to existing equipment. The job was given top priority and sample lengths of the cable were completed and tested in May 1944. After further adjustments and changes in the equipment, production was started on June 2 and continued on a 24-hour basis, 7 days a week, with the exception of a few short interruptions, until July 24 when the last shipment rolled out of the yards.

Armored cable is not so widely used in the United States as it is in England, and none of the manufacturers had machines available to do the job required without major changes in their equipment. At General Electric the drums of the 108-in. flange, 92-in. traverse steel reels were built up from 56 to 77 in., and the traversing pickup stand for these reels had a much finer and slower-speed control built into it.

A wooden guide ramp and straightening rolls were built especially for this job. The ramp was hinged so it could be dropped to the floor during splicing operations on the lead pipe. Special wooden forms were also built to hold the pipe on a proper radius during splicing.

New Steel Tape Head

An entirely new steel tape head was designed and built in the company's machine shops. Because of the fact that the steel tapes had a high carbon content, a new type of electronic-controlled welder and annealer was installed and a flame annealing fixture was built as an extra precaution to insure ductility and strength of welds.

The number of spindles on the first jute roving head was increased from 18 to 35 to get the proper length of pitch on the jute.

Fifty-seven wires were required but the armoring machine had only 48 bobbins. Therefore, a nine-bobbin cage was designed and built and was supported between the two existing cages. Backlast was eliminated by thoroughly renovating the armoring machine and installing a 4¼-in. drive shaft to drive all major elements. A new main-drive transmission was also installed as well as many new gears.

In order to prevent collapse of the lead pipe while armoring, it was kept under 40-psi. air pressure during these operations. The finished cable was shipped under an air pressure of 25 psi.

Since it was impossible to produce and handle the lead pipe in the continuous lengths required, it was necessary to stop armoring operations every 2,300 ft. (the length of pipe on one reel) and make a splice to another reel. This was done by forming the two ends of the lead pipe slightly inward, clamping them together, and making a lead-burned joint having the same outside diameter as the pipe. Special tools and gages were used for this splicing operation. Trained lead burners were not available at G-E but Philadelphia Electric Co. loaned their expert who trained two factory workers to do the job. Lead burning requires a great deal of skill and time and about 2 hours were spent on each of the joints.

The first complete pipe lines were laid from the Isle of Wight to Cherbourg and the later lines from Dungeness, England, to Boulougne, France. The water distances were 66 and 29 miles, respectively. The pipe, therefore, was shipped in continuous lengths of 35 and 70 nautical miles, or long enough to be laid across the channel without interruptions for splicing.

The cable manufactured by General Electric's Schenectady plant was shipped to Yonkers, N. Y., where it was spliced into the required lengths to reach across the channel. It was shipped in specially prepared gondola-type cars 52½ ft. long and 9½ ft. wide. A wooden floor was installed in each car and sides were lined with plywood to protect the cable in transit. A winding form, 5 ft. wide with circular ends, was installed in the center and served as a platform for the workmen doing the coiling. The height of the cars was increased to 4 ft. 4 in. by adding a 12-in. timber.

Each of the four-car shipments contained 26,000 ft. of cable in one continuous length. The cable was looped from the center of the end of

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one car to the side of the next adjacent car and protected from chafing by greased wrappings of burlap. The cars were chained together to prevent separation in transit. The cable weight of each shipment was approximately 260 tons.

The Engineer Corps had inspectors on the job continuously to make checks of quality at frequent intervals on all materials and workmanship. The company, too, had engineering supervision on a 24-hour basis—two engineers working 12-hour shifts to assist the Army inspectors and the manufacturing personnel. These engineers personally supervised practically all of the many quality-control tests. Very thorough tests were made of all raw materials, the lead pipe, and the finished product as follows:

Lead Pipe and Lead-Burned Joints

1. Quick burst on short samples of lead pipe. (Burst at 450 psi.)
2. One hour burst on long sample of lead pipe. (Burst at 310 psi.)
3. Bend tests on lead strips from lead pipe.
4. Microscopic examinations on sample rings of lead and lead-burned joints.
5. Long time tests on 40-ft. samples at 50, 75, 100, 125, and 150 psi. water pressure.
6. Burst tests on sample lead-burned joint made by each of the two operators.

Steel Strip and Steel Wire

1. Control tests of tensile strength, yield point, and elongation.
2. Daily tests on welds of both tape and wire.

Finished Cable

1. One hour hydraulic step-test at start of production on each shipping length. These samples invariably burst at about 4,000 psi.

This step test was of particular interest in showing the characteristics of the pipe. Hydraulic pressure was built up to 1,000 psi., the source of pressure shut off and the amount of pressure drop recorded after a 5-minute interval. The pressure was then raised to 1,250 psi., the drop recorded and the test continued by 250-psi. increases in pressure to failure. The amount of pressure drop indicates at the lower pressures stretching of the lead and tightening up of the whole tape and armor structure. In all samples the start of yield appeared to be in the order of 2,500 to 2,600 psi. and the burst point about 4,000 psi. A typical test curve is shown in Fig. 7.

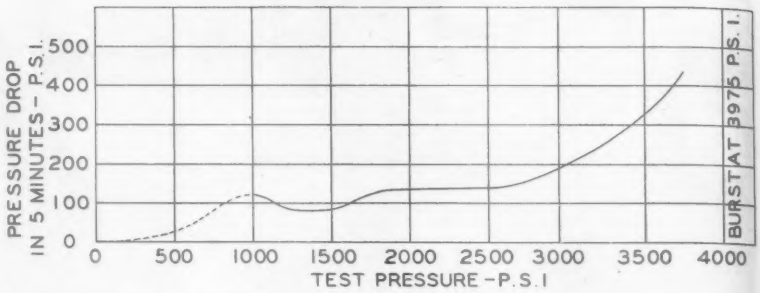


Fig. 7—Typical test chart of 1-hour hydraulic pressure step-test 3-in. HAIS pipe cable

2. Long time endurance tests at 2,500, 2,800, 3,100 psi. These tests continued for a month with no signs of distress, then discontinued.

Since the cable pipe was operated at 1,200 psi. in actual use, it had a very ample factor of safety.

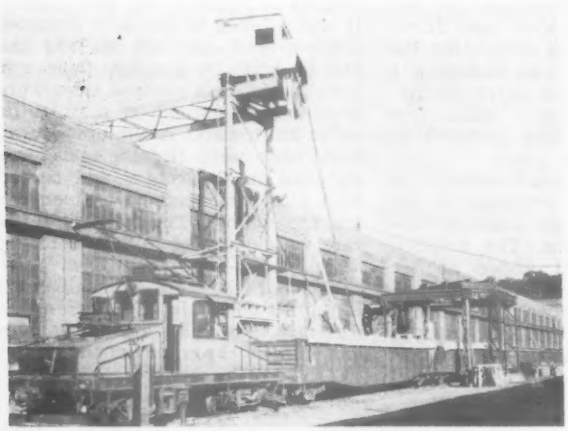
A total of 12 lines of HAIS cable pipe and 8 lines of 3-in. welded steel pipe, known as Hamel type, were installed. The whole operation was kept under a rigid secrecy order until May 1945, when details were released. According to reports, 1,000,000 gal. of gasoline were pumped through the lines daily.

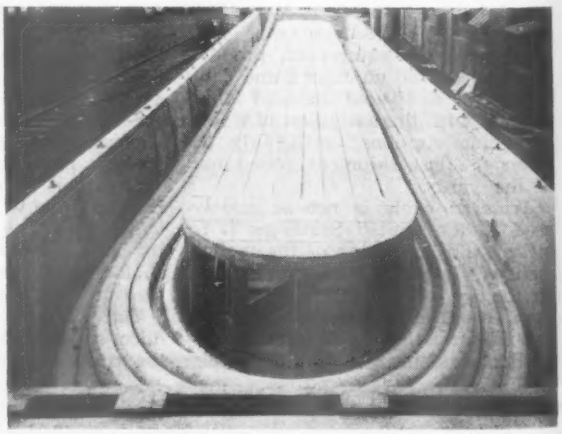
German Marshall von Runstedt is alleged to have said that the major reason for the defeat of Germany was the tremendous supply of gasoline to the United Nations' armies, which is evidence enough of the important part played by these vital pipe lines.

TABLE 1—ASSEMBLY LINE OPERATIONS

1. Supply reel equipped with tension brake. (2,300 ft. of lead pipe).
2. Special ramp to support and keep pipe straight as it went into armoring machine.
3. Vertical and horizontal rolls to round out and straighten the pipe.
4. Measuring machines.
5. First asphalt-coating pot.
6. Taping head applied two asphalt-treated paper tapes and one synthetic rubber-filled cloth tape, to act as a cushion for the steel tape armor.
7. Marker tape for manufacturer's identification.
8. Measuring machine for use by steel tape-head operator.
9. Taping head to apply four layers of steel tape, each 2 in. wide and 0.023 in. thick. (See Fig. 3).
10. Second asphalt coating pot.
11. Roving head to apply layer of 36 ends of jute roving.
12. Three wire-armoring cages, two carrying 24 bobbins of galvanized steel wire 0.192 in. in diameter and a third, specially built for the job, carrying nine additional bobbins, a total of 57 wires. (See Fig. 4.)
13. Third asphalt coating pot to flood jute layer as the wires were applied.
14. First large driving capstan.
15. Fourth asphalt-coating pot.
16. Roving head to apply layer of jute.
17. Fifth asphalt-coating pot.
18. Roving head to apply layer of jute.
19. Sixth and last asphalt-coating pot.
20. Pump applied whiting solution to prevent layers of finished cable from sticking together.
21. Second large driving capstan.
22. Vertical shaft drum to change direction of cable and pass it through door in factory wall.
23. Power-driven sheave, 40 ft. above ground level, to enable pipe to be coiled in gondola cars. (See Fig. 5.)
24. Specially prepared gondola railroad cars for shipment. (See Fig. 6.)
25. Electric locomotive to shunt cars back and forth while coiling pipe in cars.

Fig. 5—(Left) Power-driven sheave for loading gondola cars. Fig. 6—(Right) Specially prepared gondola car showing platform and plywood covered sides to protect cable





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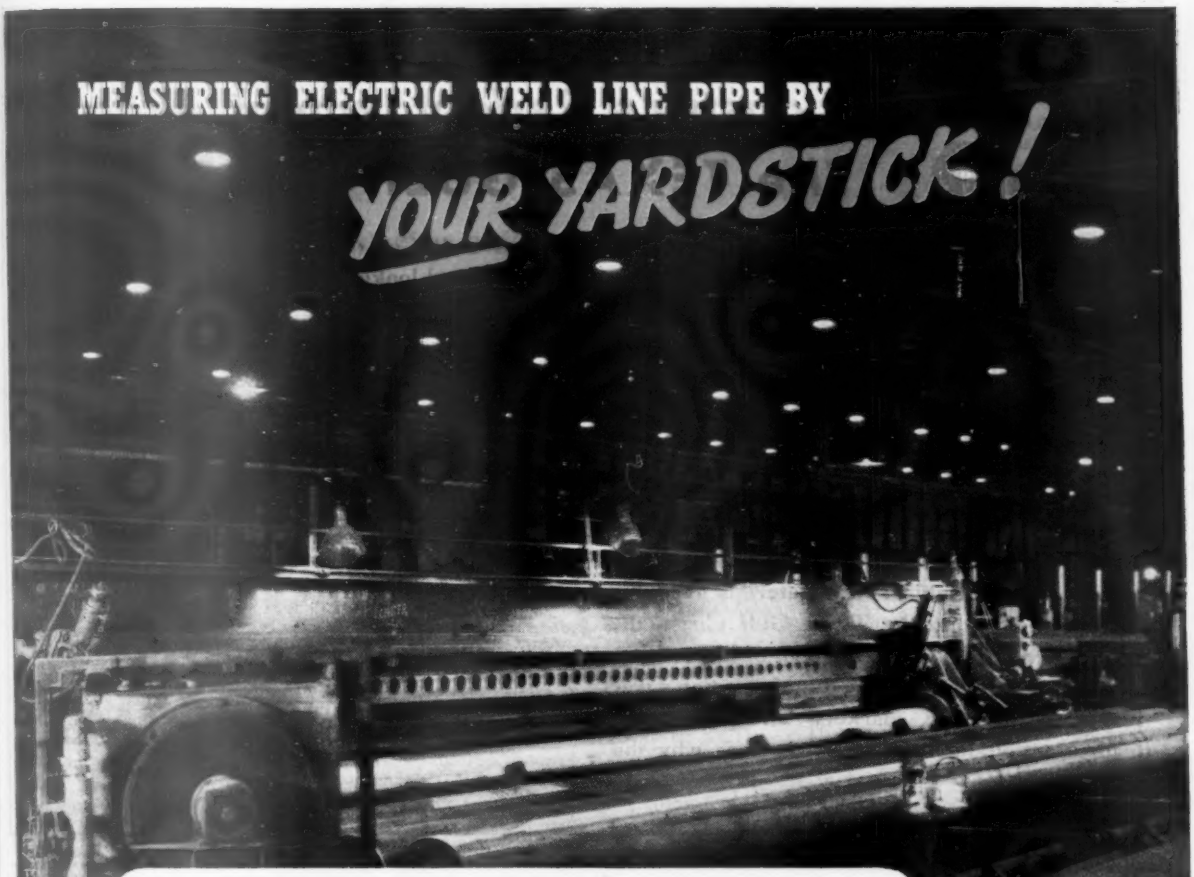

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For the company contemplating redeployment, our Research Department will compile a carefully engineered survey of the region's resources and advantages, individualized to a company's particular products and processes. This service is furnished without cost or obligation, and each inquiry is kept in strict confidence. Address your request to Research Department, Houston Pipe Line Company, P. O. Box 2412, Houston 1, Texas.

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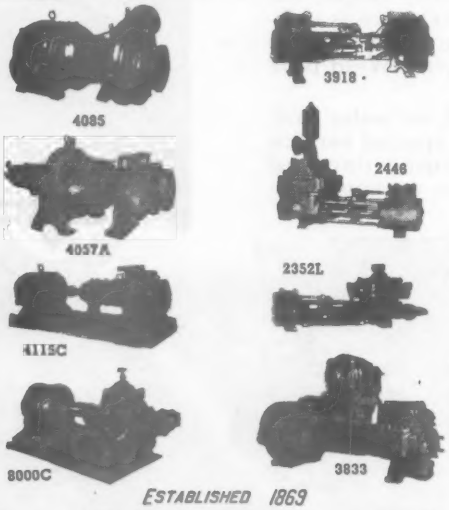

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Trussed Creek Crossings For Pipe Lines

by E. J. McConnell

E. J. McConnell, chief engineer, Oklahoma Natural Gas Co., had his early schooling at Evansville, Ind. After 2 years at Evansville College, he went to Oklahoma A. & M. College where he graduated with a mechanical engineering degree in 1936. In January 1936 he entered the engineering department of Oklahoma Natural Gas Co., and did general engineering until he was promoted to his present position in 1938.

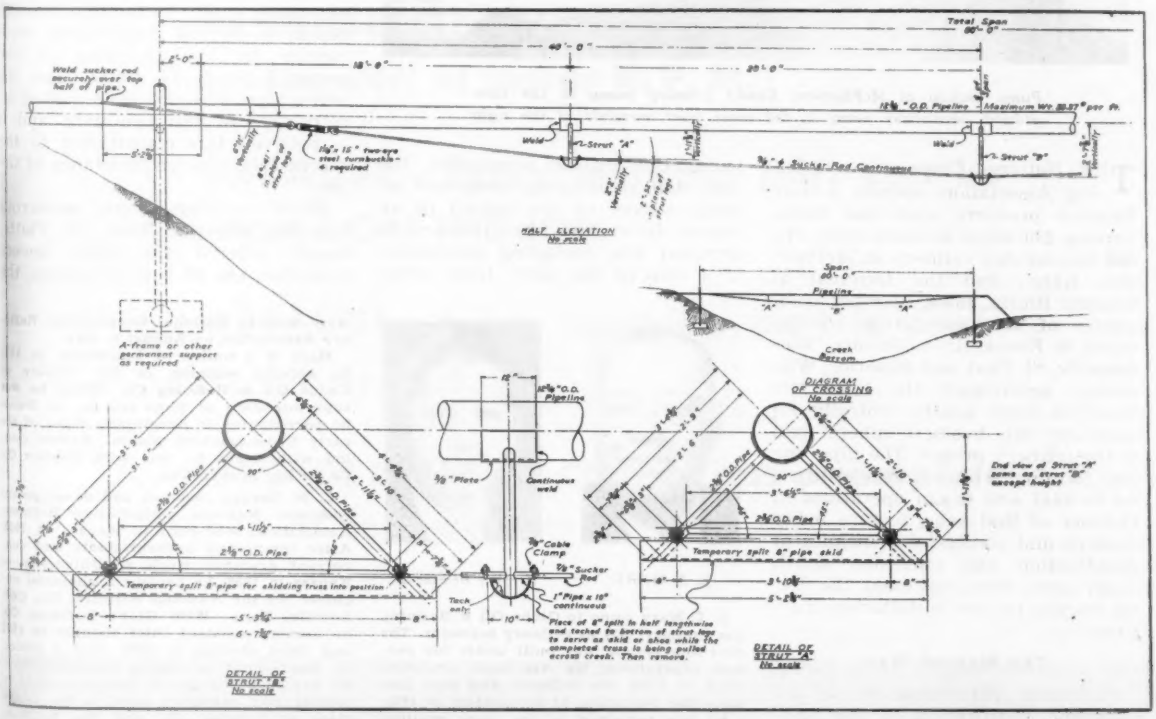
IT is a common practice to carry pipe lines overhead across creeks and gulleys, particularly where steep banks necessitate considerable excavation if the line be laid under the stream bed. On spans great enough in length to require support of the pipe between the banks, the support is generally obtained by suspending the pipe by one or more wire lines or cables with "A-frames" fabricated of pipe serving as towers. The cables or lines thus pass over the towers and are held at their ends with either concrete or junk pipe buried anchors.

Recently we have developed an alternate method of making overhead crossings, using a King-type trussed beam with the pipe serving as the upper chord or main compression member. An example is shown in the accompanying drawing. Two A-frames similar to those used on suspended crossings support the span. Struts made from 2-in. pipe are spaced at equal intervals along the pipe. To the bottom of the struts are clamped two lower chord tension members made of sucker rod or other steel rod or bar. The two tension members of each strut are "spraddled out" to give the span stability during erection and to provide resistance to wind load.

The spans are designed on uniform loading considered as the resultant of dead load and wind load. One tension rod is assumed to carry the entire load since the wind load would throw most of the stress on one rod. The lengths of the struts are calculated so that the maximum design stress in the rods is uniform throughout their lengths. Spacing of the struts is determined by analysis of the stresses in the pipe, the section of pipe between struts being considered as an axially loaded beam. Welding is used in fabrication except where the rods are attached to the struts. These points are connected by running the rod through a slightly larger pipe nipple welded into the strut. Movement of the rod through the nipple is prevented by placing clamps on the rod at the ends of the nipple. This allows for subsequent adjustment in leveling the span with turnbuckles at the ends of the rods.

The entire structure is built on the bank and then pulled across the creek. The ends are then lifted onto the A-frames with a winch truck. Split sections of 8-in. pipe are tack welded onto the bottoms of the struts to facilitate dragging over the ground. These can be left in place or cut off after erection.

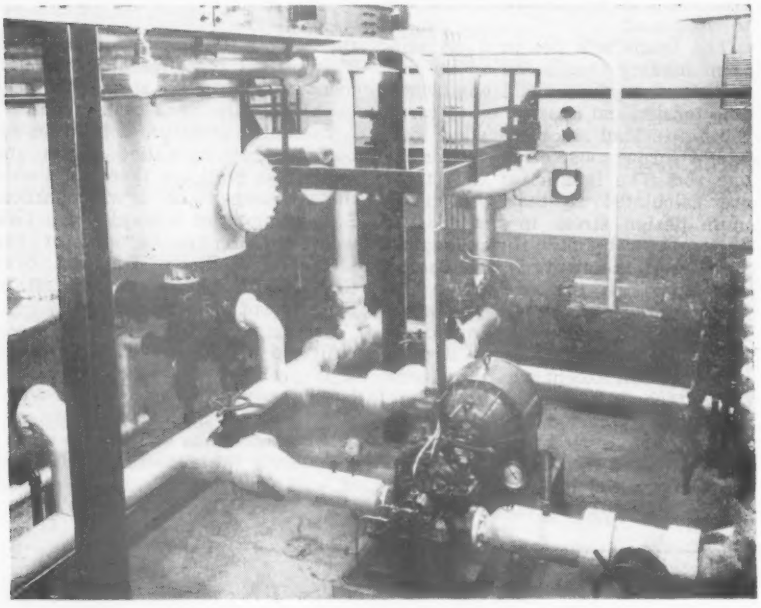
Crossings of this type have been built up to 120 ft. in length and it is probable that the length can be increased to at least 200 ft. without the design becoming uneconomical. For crossings on streams carrying debris the A-frames should be of sufficient height to give ample clearance to the lower chords.



Overhead pipe-line crossing using King-type trussed beam with pipe serving as upper chord or main compression member

Construction and Operation Of McPherson-Council Bluffs Products Pipe Line

by E. J. Mary and C. W. Berger



Pump station at McPherson, Kans.: primary pump in the foreground, secondary pump in the rear; inlet manifold at the right

THE National Cooperative Refinery Association operate a 6-in. finished products pipe line transversing 230 miles between their 17,000 bbl-per-day refinery at McPherson, Kans., and the terminal at Council Bluffs, Iowa. Member companies of this association are located in Kansas City, Omaha, Minneapolis, St. Paul, and Superior, Wisconsin; accordingly the Iowa terminal is more nearly centrally located for this business sphere than is the refinery proper. The pipe line and terminal which were constructed in 1941 and began operations in October of that year, feature many modern and successful principles of construction and operation worth study since they represent the latest prewar private installation practices.

The Right-of-Way

Following determination of the economic justification of the project and obtaining of Interstate Commerce Commission permission, the first step in planning comprised an aerial survey of the terrain in an almost direct line from refinery to terminal site, including production of a map of the route from aerial photographs. There followed land and soil surveys, together with study of river crossings and other obstructions. Finally, the right-of-way was purchased from the many land owners involved and arrangements negotiated with special owners such as represented by railroads, highways, power lines, bridges, etc.

The Pipe Line

Pipe chosen for the service was of 6-in. nominal i.d. and 6⅝-in. o.d. seamless pipe, fabricated in random lengths averaging 43 ft. and weighing 17.2 lb. per lineal foot. All pipe sections were mechanically cleaned and coated with special bituminous primer and then covered to a thickness of 7/16 in. with Somastic coating using asphalt as a base and combining graded sand, asbestos fibre, and limestone dust. Two pipe processing plants were set up; one at Abilene, Kans., and the other at Cook, Neb., to centralize pipe cleaning and coating. Mill run pipe was delivered to the plants by rail. Finished, coated pipe was routed by transport trailers equipped with cushioned bolsters. Coated pipe sections were distributed along the pipe trench, elevated above the trench, welded together, and the welded joints Somastic coated by hand.

The pipe was then tested for leaks in welds, etc., with air pressure, and the coatings tested for continuity and electric resistance by a traveling brush type conductance indicator. Section after section was buried as completed, extreme care being taken to avoid entrapment of any water or dirt in the line. Smooth bends to fit the topography were formed by cold bending at the scene. It is to be noted that the entire line was Somastic coated irrespective of soil condition and it is believed this contributed to the successful corrosion resistance of the line.

River crossings were numerous but the Missouri River at Plattsmouth offered the most severe problems. On all such crossings, the

E. J. MARY

C. W. BERGER

E. J. Mary came to Globe Oil & Refining Co. January 1934 as refinery manager. The pipe-line system was built under his general supervision. He has been operating head of both the refinery and pipe line since the beginning of the project in 1941. He has remained in the same position since the pipe line, terminal, and refinery were sold to National Cooperative Refinery Association on August 1, 1943.

Mary is a native of Louisiana; in 1915 he entered refining in the employ of Caddo Oil & Refining Co. When he was superintendent of Sims Oil Co. at Dallas he participated in developing some of the early Cross-cracking plants. Before coming with Globe he was with Cosden Oil Co. at Big Spring, Tex.

C. W. Berger, research and development engineer, National Cooperative Refinery Association, was born in Kansas in 1908. After completing undergraduate and concurrent graduate work at University of Kansas in 1930, he became a chemical engineer for the National Refining Co., Coffeyville, Kans. With Globe Refining Co. he became assistant chief chemist in 1933 and chief chemist in 1936. For a period he has served as acting superintendent. He has been engaged in studies related to critical war activities both at the Globe plant at Lemont, Ill., and the N.C.R.A. refinery at McPherson, Kans.

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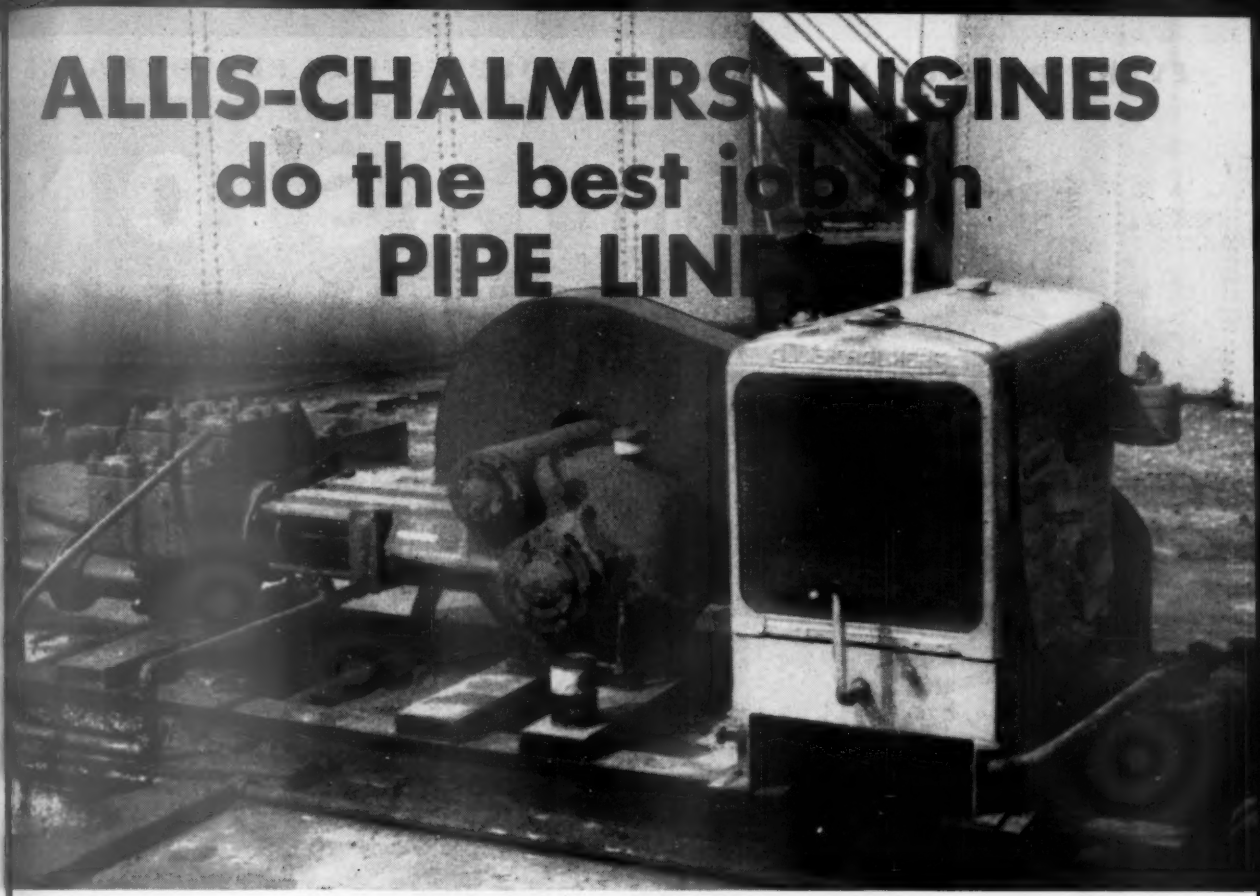

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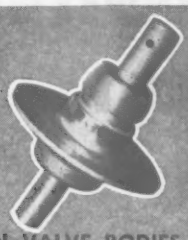

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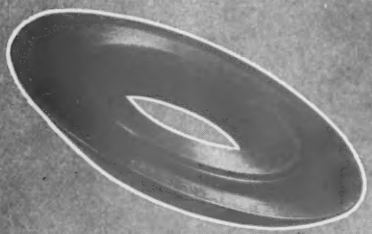

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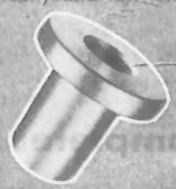

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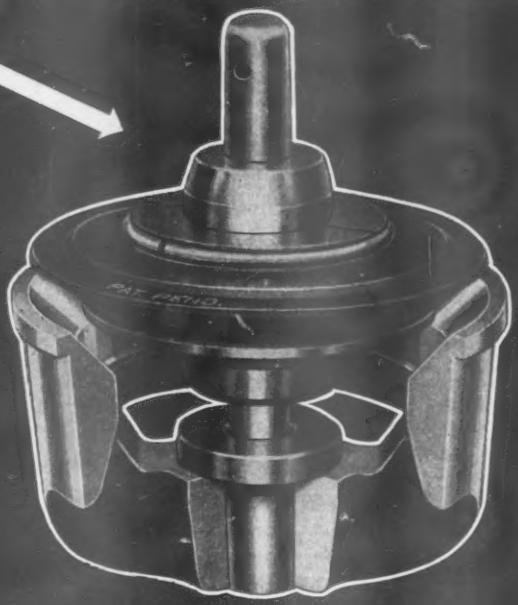

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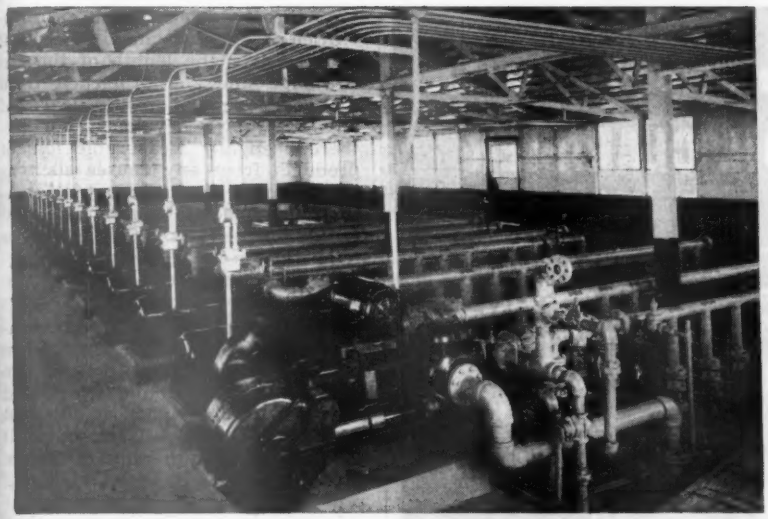


Council Bluffs, Iowa, terminal receiving station and transfer pump house

pipe was inserted in a 10-in. casing and the casing pumped full of hot asphalt. At the Missouri, the cased pipe was laid out across pontoons and drawn into an arc upstream to present a bulge facing the current. Sufficient 1,000-lb. river clamps were attached to bring the average weight of the cased pipe to 100 lb. per foot. After being lowered into place on the river bed, dredges pumped from under the pipe allowing it to settle at least 18 ft. below low water level; depth of the line below the river bottom averages 4 to 5 ft. All river crossings were handled by submerged, asphaltized castings with suitable clamps. In the case of smaller creeks with high banks, suspension crossings or supported over-bends were used. The entire construction job, including trenches, pipe laying, river crossings, scraper station settings, etc., was completed in 60 working days or at a rate of nearly 4 miles per working day, with several crews operating simultaneously.

Pipe Condition

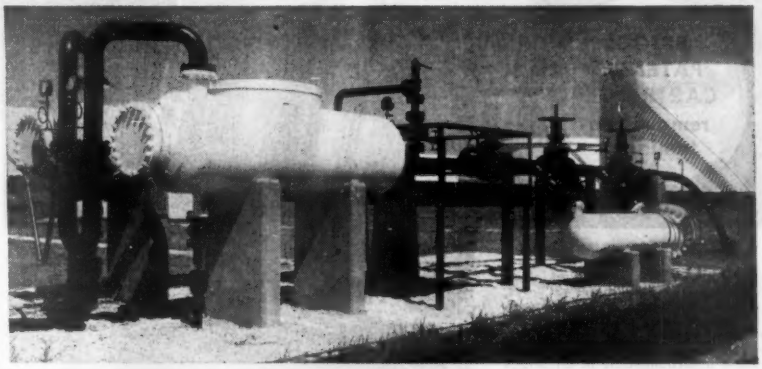
The NCRA pipe line was tested with air rather than water, and since its initial operation, water has been carefully kept out of the line.

The C factor of the line is essentially as high today after 4 years of continuous operation as at the start. Initial tests showed 156 C factor while recent tests stand at 154. Although scraper stations were provided, no scraper has ever been through the line except for the trash cleaning "pig" used ahead of the first commodity filling of the pipe.

Products ranging from light gasoline to No. 2 fuel oil are pumped, and one batch follows the other as manufactured except that occasionally an intermediate-boiling tractor-fuel cut is inserted as a short slug between very light and very heavy products. Interfacial contamination is negligible and no slop has ever been shipped back to the refinery for rerunning.

Provisions were made for determining induced current in the line by installing electrodes each of which consisted of a brass rod welded to the pipe at intervals of 3 to 5 miles. These rods were protected by encasing them in 2-in. pipe insulated from the pipe line by Somastic; the annular space between the brass rod and the 2-in. pipe was filled with hot asphalt. By means of these brass electrodes it is possible to get a positive check on the condition of the Somastic coating covering the entire line. Data for this purpose can thus be obtained without digging up the line for inspection.

Installation of the brass rods was made in anticipation of a later need for cathodic protection, furnished 1½ years after the line was put in operation. For cathodic protection, ground beds and copper oxide rectifiers were installed at two points along the line for supplying a small amount of current (4 amps. at 4



Settling chamber and scraper-trap equipment at the Council Bluffs terminal. The larger horizontal drum provides for velocity reduction to allow fine sediment to settle from products. It is constructed to allow for occasional bypassing and cleaning. The procedure followed comprises of weighing and chemically analyzing of deposited matter as a check on the condition of the interior of the pipe line. To date deposits have been small

View of Council Bluffs, Iowa, terminal

Nothing to get out of order in this

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volts direct current) which has been sufficient to balance electrical charges over the length of the entire pipe line and protect it from electrolytic corrosion. No leaks of any kind have developed nor has there been any measurable loss of products from any causes such as pipe taps or line breakage. Attention is immediately given to land erosion caused by precipitation or temperature changes. For this purpose small line crews are stationed along the line.

Pressure balancing tests are conducted regularly on the line when it is shut down. This is done in the following manner: Pumps are slowed and the terminal gate at the end of the line is gradually closed until the line has a minimum of 200-lb. pressure at all points. Of course, pressure at the refinery end is considerably higher. Pumps are then stopped and all line gates are closed; thus, with eight gate valves, the line is divided into seven sections. Line pressures normally stabilize themselves within 12 hours as evidenced by pressure readings on both sides of all gate valves. Failure to stabilize would be indicative of leaks calling for immediate investigation. Regular C factor determinations are made when the line is in operation.

Products entering or leaving the line are not metered, but accurate tank gages are taken hourly at both ends and compared in volume by regular telephonic communication. Failures to pump or receive according to prearranged schedule are immediately noted by phone. The positions of heads of new batches in the line are kept hourly by both ends by means of a 30-ft. dispatching board portraying the line in miniature and positioning batch head locations by suitable indicators.

At the terminal, a sensitive specific-gravity recorder provides warning of gravity change in products received and serves substantially to signify the proper instant for tank switching on commodity changes. The recorder is supplemented by manual sampling a few minutes before and after a batch is received. Batches are so dispatched that tank switching seldom occurs at less than 24-hour intervals and often several 24-hour periods ensue between batches. Daily pumping and line inventory statements are prepared by the refinery office, thus providing a running log of operations, delivery rates, and commodity balances.

Motivation and Instrumentation

The main pumping station at the refinery site is capable of picking up products at the inlet manifold at atmospheric pressure and discharging them into the full line at 1,000 lb. and with sufficient velocity to move more than 7,000 bbl.

per day into storage at Council Bluffs, 230 pipe-line miles away.

For this movement of products two electric-driven centrifugal pumps operate in series. The primary is 2-stage pump driven by a 100-hp. motor which increases pressure from atmospheric to 300-lb. gage. The secondary pump is 8-stage driven by a 200-hp. motor which increases pressure from 300 lb. to 1,000 lb. Present operations are balanced at the maximum capacity of these two pumps located at the refinery, but, whenever necessary, the flow may be increased by means of a booster station with duplicate electric centrifugal pumping equipment at Blue Rapids, Kans., in order to attain a total capacity of approximately 9,000 bbl. daily.

The elevation at McPherson is 1,475 ft. while at Council Bluffs it is 965 ft. The high point between these locations exists beyond Blue Rapids where the elevation is 1,465 ft. The Blue Rapids pump station itself stands at 1,120 ft. above sea level.

An interesting feature of the booster station is its cooling system for pumps which operates differently than at McPherson where pumps are water cooled. Since water cooling was impractical at Blue Rapids, provision was made to have product leakage over the metallic packing serve to cool. The product leakage is controlled and collected in a small reservoir from which it is immediately returned to the pipe line by a small close-clearance pump. There is thus no accumulation of products at the station and no problem of disposal.

The Terminal

At Council Bluffs the pipe line ends in a large efficient terminal constructed and operated for fast delivery of products by highway transport and rail. The terminal site, comprising 40 or more acres, is located on U. S. Highway 275 just south of the city. Storage facilities for 400,000 bbl. vary from 55,000-bbl. floating-roof tanks to 500-bbl. bulk loading tanks. All major storage tanks are equipped with electrical mixers operated from a central control panel, and with tank side automatic gages. Product dyeing and mixing are facilitated by such modern equipment.

The transfer pump house encloses all manifold valves and a battery of electric-driven centrifugal pumps. It serves as the pipe line receiving and switching station.

Offices, laboratories, warehouses, and truck repair buildings are provided.

The tank-car loading rack comprises 16 spots with almost unlimited switching facilities. The tank truck loading dock has 32 spouts, each loading line provided with automatic recording meters; and each commodity line is equipped with air eliminators.

Six main highways provide transport in all directions from the terminal which has recorded over 11,000 bbl. of finished products loaded in a 24-hour period into highway transports alone. Transport loading at McPherson and Council Bluffs provide interlacing distribution routes substantially covering the business sphere of the association except for rail delivery to outlying points plus exchange points arranged with other companies. This system was particularly helpful during the war period and has contributed considerably to necessary reduction of rail hauls in the area.

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An average of 1 gal. of gasoline per day is needed for every soldier engaged in offensive operation. Army requirements show that for a smooth, fast-moving operation the gasoline consumption of an army runs as high as 1.5 gal. per man per day. In static operations, this figure is somewhat below the gallon-per-man-per-day figure.

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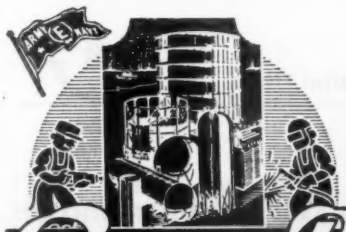

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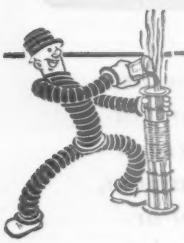

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Pipe being pulled in place showing one of the mine cars dropping away from pipe down the inclined spur track

by A. Spratling

The author has been supervising field crews for 10 years, and has handled most of the numerous river crossings as well as other pipe-line work throughout the company's system. He has been a member of the Pacific Gas & Electric Co. engineering staff for 17 years.

Special Measures Employed in Dual Gas-Line River Crossing

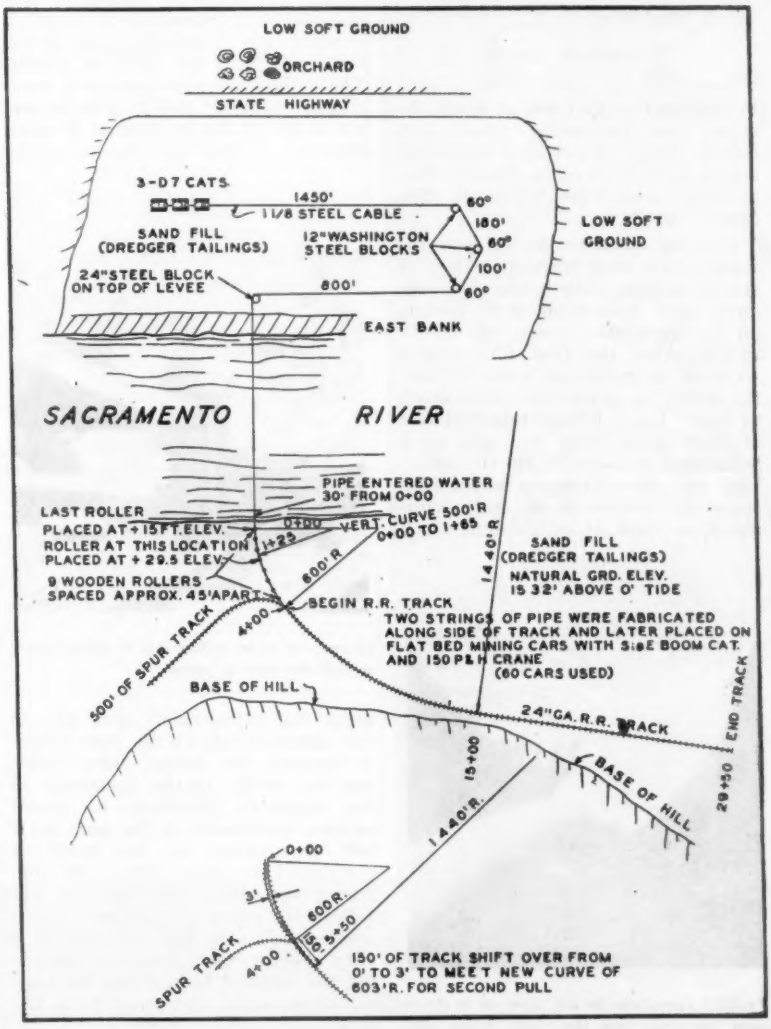
THE Rio Vista gas fields, located 50 miles northeast of San Francisco, are the principal source of natural-gas supply for the Pacific Gas & Electric Co.'s systems.

The fields are divided into two parts by the Sacramento River, a navigable stream about ½ mile wide and 30 ft. deep. This river is controlled by the U. S. War Department and other government agencies and must be kept open to traffic at all times.

In 1944 the increased demands for gas by war industries in the San Francisco Bay area required the installation of two additional 10-in. gas mains connecting the east and west fields.

Certain unusual conditions required a departure from regular method of submarine pipe-line installation. Governmental restrictions prohibited depositing of excavated materials in the river channel, and as dump barges were not available, a clamshell dredger could not be used for excavating the trench under the river.

A 16-in. electrically operated suction dredge with 1,500 ft. of 20-in. floating discharge line was therefore used and excavated material



Layout for dual 10-in. gas line crossing Sacramento River, Rio Vista

spread in areas selected by government engineers, including a small piece of low swamp land, about 200 ft. wide, between the levee on the east side of the river and the state highway, thus reclaiming it in this manner for farm use and also providing a place on which our caterpillar equipment could travel while pulling the pipe across. Excavation of approximately 100 ft. of trench near the east bank, which was protected by rock rip-rap, and about 50 ft. at the west bank, where broken piling and trees were encountered, was done with a floating clamshell dredger.

Correct alignment of the 20-ft. wide trench was maintained through targets on shore, electric lanterns being placed on the targets for night operation. Grade changes were marked by staff buoys. Very little sloughing took place, the sides of the trench standing on a slope of approximately 2 to 1. Depth of excavation varied from 7 ft. to 22 ft. below river bottom and approximately 63,000 cu. yd. of material were excavated.

Compound Curve

Because of a range of hills lying to the west of and 900 ft. from the river, the launching track and rollers were laid out on a compound curve instead of on a straight line directly away from the river. (See layout sketch.)

Starting at station 0+00, near the water edge, nine wooden rollers of special design, with hemp rope lagging were placed on 45-ft. centers on a horizontal curve of 600-ft. radius. Also, the first four rollers were set on a vertical curve of 500-ft. radius to bring the pipe down to water level. Eleven hundred feet of 24-in. gage track was laid on a horizontal curve of 1,440-ft. radius. This was started tangent to the first curve at station 4+00 and terminated in 1,400 ft. of straight track which was approximately parallel to the river.

Ten-inch Somastic coated pipe on rollers, being pulled in place

A curve of 1,440-ft. radius is about the limit to which this pipe can be deflected and remain on the cars while they are being moved. Therefore, in order to deflect the pipe a full 90° so that the approach to the river was at right angles to it, and within the available space, it was necessary to introduce a curve of smaller radius and make use of the rollers to hold the pipe on course. The rollers were placed on a horizontal curve of 600-ft. radius and set at 22° to the horizontal to compensate for the side thrust of the pipe. An extra roller was set on the opposite side of the pipe where it entered the water. This roller was set at 22° to the horizontal in the opposite direction to guard against oscillation of the pipe as it left the rollers. At the point of compound curvature, where the pipe transferred from the cars to the rollers, the track was laid in a sharp reverse curve to the left and on a very sharp decline, thereby providing the method for getting the cars out from under and away from the pipe.

Closeup of roller with cable in place ready to pull the pipe in place

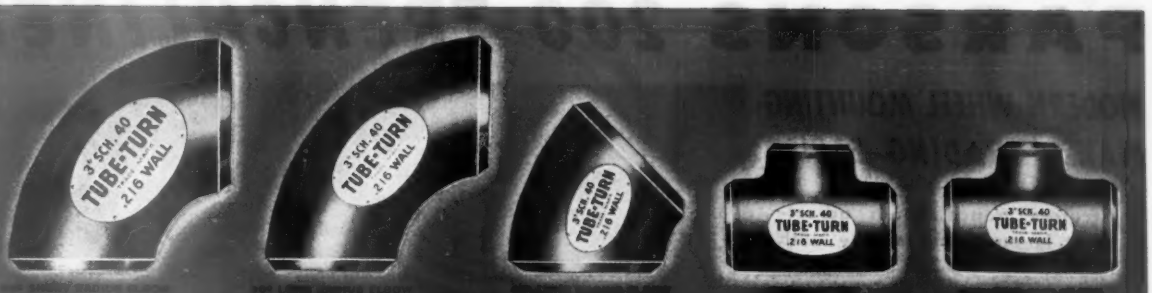
The submarine pipe is 10¾-in. o.d. Somastic coated weighing 60 lb. per foot. It was received at a nearby railroad siding, trucked to the job site and stockpiled. Because the track was laid on blow sand it was impossible to use pneumatic-tired equipment on the job. The pipe was carried and strung along the track with a caterpillar tractor equipped with side boom. Welding machines, Somastic pot and all ather equipment was towed by caterpillar tractors.

The two pipe lines were fabricated parallel to and adjacent to the track. The pipe joints were arc welded by the stove-pipe method and tested with soap suds under 100 lb. air pressure. After the field joints had been treated with Somastic coatings both pipe lines were tested with a "holiday detector."

Flat deck mine cars were placed on the track at 42-ft. intervals and the first pipe section was placed on the cars. This pipe section was moved ahead until the first 400 ft. rested on the pipe rollers and the head end was at the water edge. A bumped head was welded to the pipe end and a bail of ½-in. by 3-in.

Vertical curvature in the pipe as it drops from the bank into the river. Barge supporting end of pipe in midstream

Barge with steam winch with line supporting end of pipe off of bottom of trench across river. Picture shows beginning of the pull



TUBE-TURN

TRADE MARK

WELDING FITTINGS AND FLANGES

TUBE-TURN WELDING FITTINGS—RANGE OF SIZES

Type of Fitting	Description	Standard Weight	Extra Strong	Schedule 160	Double Extra Strong	Light Gauge	
						Nominal Pipe Size	Iron Pipe Size
Elbows	90° Long Radius	½"-24"	¾"-24"	1"-12"	1"-8"	4"-24"	3"-12"
Elbows	90° Short Radius	1"-30"	1½"-30"				
Elbows	45° Long Radius	½"-30"*	¾"-30"*	1"-12"	1"-8"	4"-24"	3"-12"
Returns	180° Long Radius	½"-24"	1"-24"	1"-12"	3"-8"	4"-24"	3"-12"
Returns	180° Short Radius	1"-30"	1½"-30"				
Returns	180° Extra Long Radius	1"-2½"	1"-2½"				
Tees	Straight	¾"-24"	¾"-24"	1"-12"	1"-8"		
Tees	Reducing Outlet	¾"-24"	¾"-24"	¾"-12"	1"-8"		
Reducers	Concentric & Eccentric	1x⅜-24x20	1x⅜-24x20		1x⅜-12x10		
Caps		1"-24"	1"-24"		1"-8"		
Stub Ends	Lap Joint	1"-24"	1"-24"				
Nipples	Shaped, 90° to Header	1¼"-12"	1¼"-12"				
Nipples	Shaped, 45° to Header	1¼"-12"	1¼"-12"				
Saddles		2"-24"**					
Laterals	Straight	1¼"-24"	1¼"-24"				
Laterals	Reducing-on-Run	1¼"-24"	1¼"-24"				
Crosses	Straight	¾"-24"	¾"-24"				
Rings	Welding	¾"-12"	¾"-12"				
Sleeves	Welding	2"-24"**					

SUPER Tube-Turn 45° long radius elbows, 90° long radius elbows, and 180° long radius returns available in both Standard weight and Extra Strong in sizes from 3" to 12".

Tube-Turn welding fittings and flanges conform to applicable ASA and ASTM Standards. For further details please refer to Tube Turns catalog and data book No. 111.

*30" size short radius.

**Since saddles and sleeves are used for external reinforcement only, they do not conform to iron pipe size thicknesses.

TUBE-TURN FORGED STEEL FLANGES—RANGE OF SIZES

	150 Lb.	300 Lb.	400 Lb.	600 Lb.	900 Lb.	1500 Lb.	2500 Lb.
Welding Neck	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Slip-On	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Lap Joint	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Threaded	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Blind	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Socket Type	¼"-24"	¼"- 4"		¼"-3½"			
Reducing-threaded or slip-on	¾"-24"	¾"-24"	¾"-24"†	¾"-24"	¾"-24"*	¾"-24"	¾"-12"
Orifice—threaded		1"-24"	4"-12"	4"-12"	3"-12"	1"-12"	
Orifice—slip-on		1"-24"					
Orifice—welding neck		1"-24"	4"-12"	1"-12"	3"-12"	1"-12"	
Long Welding Neck	1"-24"	1"-24"	1"-10"	1"-10"	1"-10"	1"-10"	

†Dimensions on sizes thru 3½" same as for 600 lb. flanges.
*Dimensions on sizes thru 2½" same as for 1500 lb. flanges.

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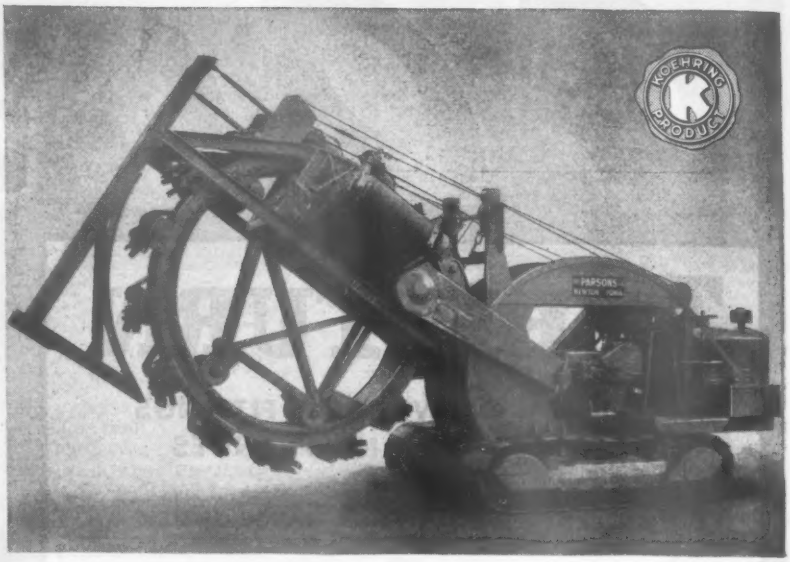

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flange steel was welded to the bumped head.

The pipe lines were pulled across the river, one at a time, by a cable from three caterpillar tractors on the east bank.

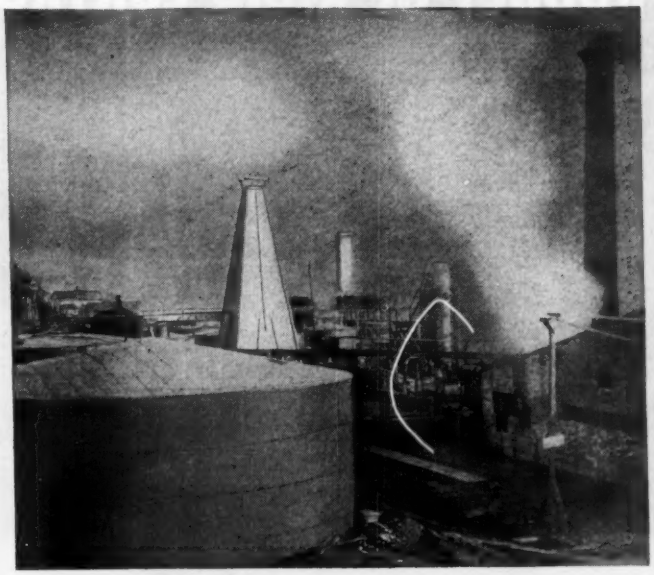
In pulling the pipe lines across the river a rather unusual problem was confronted. A winch, powerful enough for the purpose was not available and space in which tractor equipment could travel was limited to a strip of land about 1,480 ft. long lying between the east river levee and a major state highway, a distance of 200 ft. To the north and to the south of this strip of land, there is low marshy ground, and on the east side of the highway is a pear orchard and low soft ground.

A dead man was placed on line on the east bank and a 24-in. steel block attached to it. At a distance of 800 ft. downstream, three dead men were placed with separation of 100 ft. and 180 ft. (See layout sketch.)

Pulling Pipe Across

For pulling the pipe across, a 1⅛-in. steel cable was laid across the river, one end was fastened to the "bail" on the end of the pipe, and the other end was threaded through the steel block on the east bank and attached to the draw bars on three D-7 caterpillars pulling in tandem. The rear cat also towed a stone boat on which rested three 12-in. snatch blocks that were threaded on the 1⅛-in. tow cable. In starting the pull, the cats traveled at right angles to the pipe line, downstream for 800 ft. to the first dead man. When that point was reached, the loop of the dead man cable was hooked onto a snatch block and the block allowed to slide off of the stone boat. The caterpillars then angled to the left about 60° and approached the second dead man. When this dead man was reached, the second snatch block was attached to the dead man lines and allowed to slide off of the stone boat. The caterpillars made another turn of 60° and approached the third dead man where the performance was repeated and the caterpillars were headed upstream and parallel to the river bank. In this manner it was possible to change the direction of the pull through 180° without stopping the forward progress of the pipe.

The first time that the 1⅛-in. steel cable was laid across the river, the cable reel was placed on a small barge and the barge was towed across the river, the cable being allowed to unreel and lay on the river bottom. The second time, it was dragged across by a tug boat. The cable was fastened to the "bail" on the end of the pipe by a ball-bearing swivel and shackle.



Famous Facts

On January 22, 1861, the fires were lighted under the still at the first oil refinery in the world near Titusville, Pennsylvania. That first crude cost $10 a barrel, but before the product could be put on the market the same crude could be bought for $2. Refineries soon sprang up through the Pennsylvania region. One of the earliest was the Acme Refinery, shown here, at Titusville.

The first protective coating of its kind — introduced about the time the first oil refinery was built — was hot applied Bitumastic Enamel. Its early use for the protection of ship surfaces exposed to severe corrosive conditions was so successful that it was soon utilized by a wide variety of industries as a coating for underground and underwater metal surfaces.

As a pipe line coating Bitumastic Enamel combines the unusual advantages of high viscosity, good adhesion, maximum flexibility and resistance to soil stress. It has been used on over 10,000 miles (excluding small diameter service pipe) of oil and gas pipe lines and has a longer performance record in resisting corrosion than any other coating.

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After the first pipe had been dragged across, the rollers were moved to the left, a distance of 3 ft., to give separation on the two lines. The first 200 ft. of track was warped over on a curve tangent to the new position of the rollers and the second pipe string was placed on the cars by a side boom caterpillar and crawler crane. This second pipe was then moved forward onto the rollers and the end of the cable, which had been dragged back across the river by a tugboat, was fastened to the "bail" and the pipe was launched in the same manner as the first one. The forward end of the pipe, in both operations, was held about 3 ft. above the trench bottom by a line from a steam winch on an anchor barge. This barge was allowed to float free and was towed only by a cable to the pipe. The launching was programed to coincide with the tide flows, both pulls being made at slack water. The first pull was made at about 11 a.m. and the second pull at 3 p.m.

Vertical Bend in Pipe

Due to an abrupt grade change near the east side of the river it was necessary to put a slight vertical bend in each pipe. The bending was done after the pipe lines were in place. A piece of 10-in. pipe, 80 ft. long, with a steel bending shoe attached to the lower end was slung into the leads of a floating pile driving rig. The pipe and shoe were lowered until the shoe rested upon the submarine pipe at the desired location. Pressure from pile driver was applied to the shoe so that the submarine pipe would stay in the bottom of the trench. A line from a floating derrick was attached to the free end of the pipe and it was raised until the correct amount of bend had been put into the pipe. A diver assisted in spotting the bending shoe and inspected the pipe coating after the bending had been completed.

The final inspection of both pipe lines, including soundings at 40-ft. intervals, was made by a diver.

Communication across the river, during launching operations, was by short wave radio.

Backfilling of the trench was done with a floating clamshell dredger. Pipe-line fabrication and construction of launching facilities were carried out during the forepart of December 1944, and the pipe lines were installed across the river on December 23.

The work was carried out under the general supervision of O. W. Peterson and J. A. Love. The field work was directed by A. Spratling, the author, assisted by the following men: J. A. Oldham, R. E. Wetter, M. E. McWherter, W. W. Welter and P. H. Wagner.

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Two-Way Radiotelephone For Pipe-Line Operation

by F. T. Clarke

THE ability of radiotelephone signals to surmount obstacles which ordinarily create a problem even for the telephone lines, is being used to establish a communications network to act as an aid to pipe-line operation in Southwest Louisiana.

In April 1944, Reconstruction Finance Corp., Office of Defense Plants, formerly Defense Plant Corp., an instrumentality of the U. S. Government, authorized The Union Sulphur Co., Inc., of Sulphur, La., to construct a communications system for approximately 100 miles of gas pipe line which that company is operating for them. This line furnishes gas to various war plants in the vicinity of Lake Charles, La., and about one-third of the line traverses swamps and salt marshes. Because of the ease in which radiotelephonic communications are established in such terrain, it was decided to install a radio network for this communication system.

The installation consists of one 250-watt station, Motorola-Galvin Model FS TR-250BR operating at the sulfur mines with a 250-ft. tower, 12 portable radiotelephone units, Motorola-Galvin Model FS TR-50BY, and 5 mobile radiotelephone Units, Motorola-Galvin Model FM TR-50DM for installation in cars. The frequency on which the system operates is 33-620 k.c. and the type of emission is f.m. The total cost of the installation was approximately $20,000, which considering the use to which the system has been put, is a small amount to expend for the return received.

F. T. Clarke chief civil engineer, The Union Sulphur Co., Inc., after graduating from Louisiana State University in civil engineering, worked with a consulting engineer as inspector of pumping plants and other public works from 1928 to 1930. From 1930 to 1933 he was resident engineer of the Louisiana Department of Highways; 1933 to 1934 dredging engineer with McWilliams Dredging Co.; 1934 to 1935 computer for U. S. Coast and Geodetic Survey; 1937 to 1942, engineering auditor for Louisiana Department of Highways. In June 1942 Clarke entered his present position with Union Sulphur.

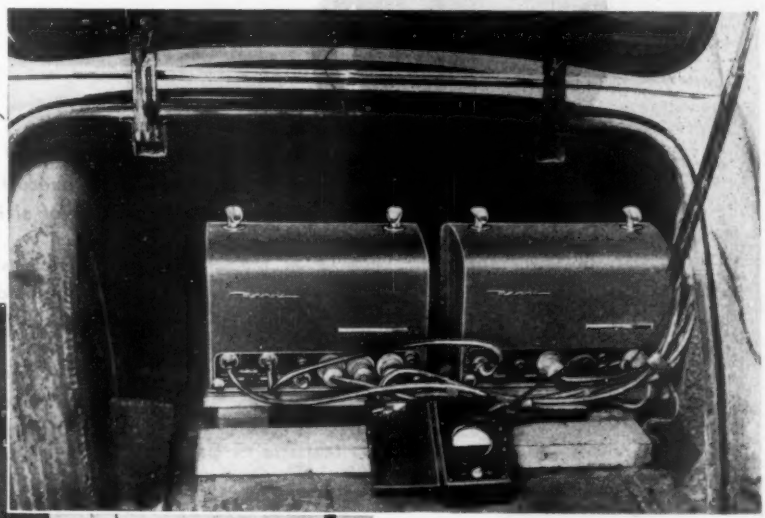
Purchase of the equipment was approved by War Production Board, and Federal Communications Commission gave the required construction permits for the installation to proceed. Later these construction permits were exchanged for station and equipment licenses.

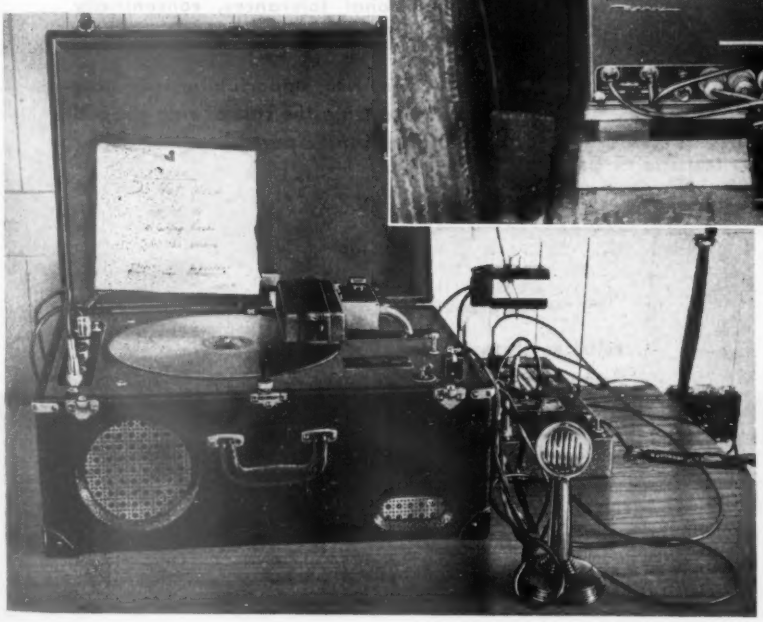
FCC also granted the company permission to start operating the system with a single radio operator who holds the required licenses. John E. McNamara, holding both a radiotelephone first class and a radiotelegraph first class license, is responsible to the commission for adherence to its regulations. The commission cooperated still further, and when 101 employes of Union Sulphur Co., made application for operator licenses it sent one of its radio inspectors to give examinations.

Further cooperation of the commission in assisting the company

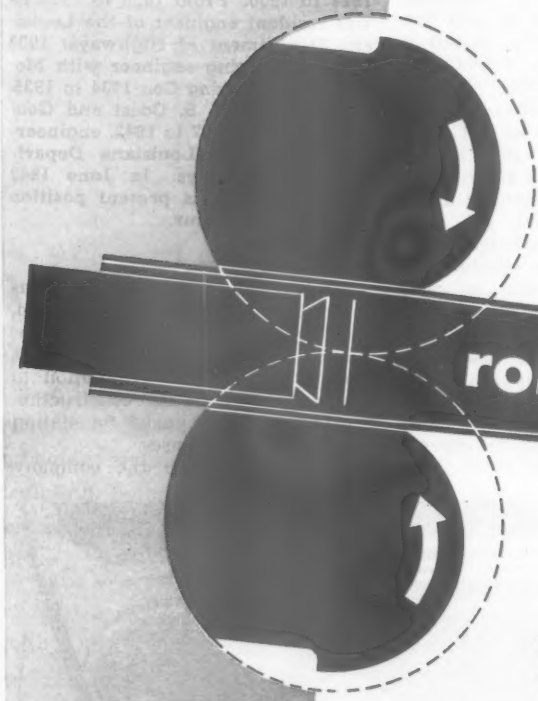
Below—For the first time the logs and records required by Federal Communication Commission are, with its permission, being kept by an automatic recording device. Everything transmitted over the entire network is recorded. This speeds up operation of the entire system by eliminating need for keeping written records each time transmitters are used

Right—Typical mobile installation of two way radiotelephone installation





Rockrite TUBE SIZING



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It brings about these important results because the Rockrite process of sizing tubes differs radically from the customary cold-draw method of producing mechanical tubing. In the Rockrite process the tubing is rolled to size in a combination of compression, cold forging and extrusion. Many tolerances are half—or even much less than half—those of conventional tubing.

This means that ball-bearing races, ferrules, sleeves and similar parts can be machined from Rockrite tubing faster and at lower cost than is possible with ordinary tubing.

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The Rockrite process is adaptable to many grades and analyses of steel—and other metals, including those that are difficult or impossible to cold draw. Its cold working of the metal can be taken advantage of to raise the physicals of certain steels such as SAE X 1020.

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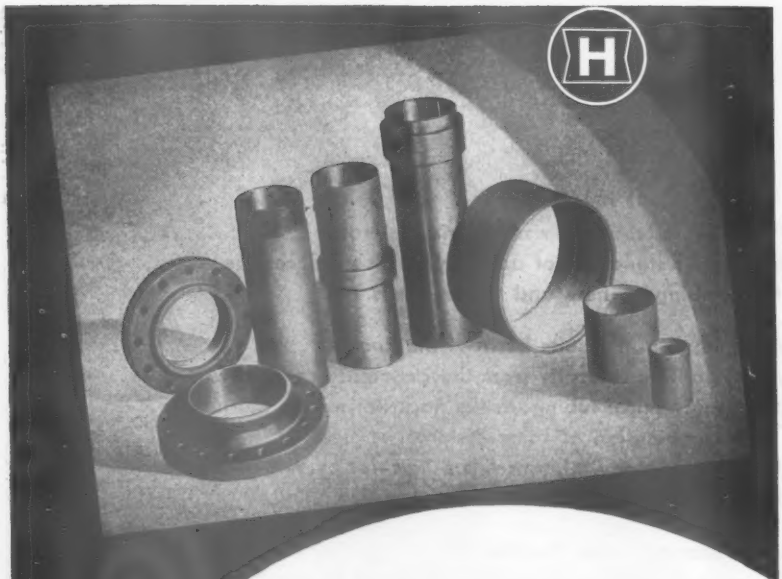

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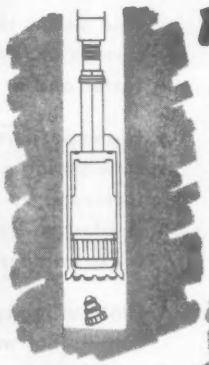
COOPER DIE-FORMED BASKET

has ALL the Junk!

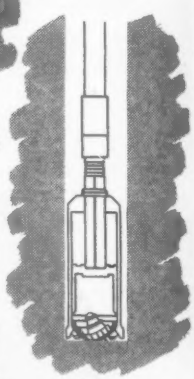


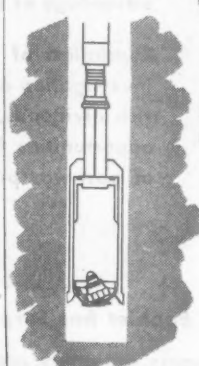
1 ON THE BOTTOM

The Cooper Die-Formed Basket, attached to the drill pipe by your own crew, is on the bottom, ready to work. No need to circulate, rotate or to make hole.

FINGERS MAKE BASKET 2

Weight applied to the drill string drives the steel fingers through the die, bending them into a tight basket.





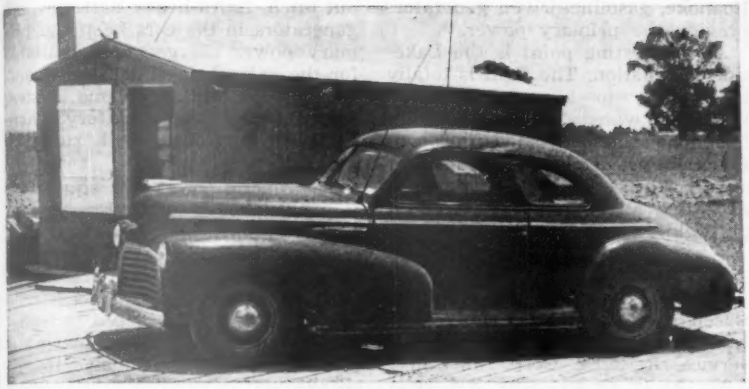
3 ON THE WAY UP

As the fingers curve out and interlock, they scrape the bottom of the hole, picking up and retaining all the junk, big and little. A clean hole in 3 minutes!

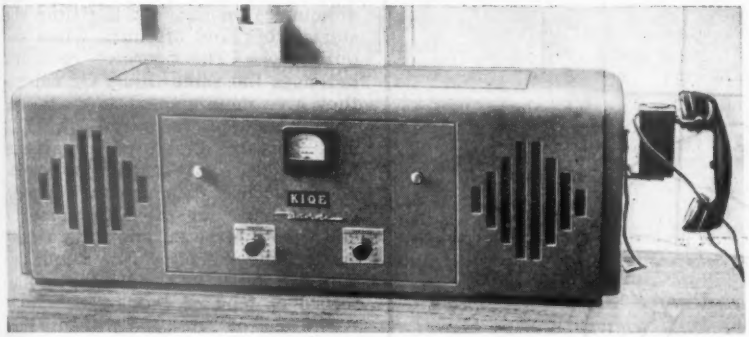
GET A COOPER BASKET FROM

Oklahoma—Acme Fishing Tool Co.
Texas—Wilson Supply Co.
California—Baash-Ross Tool Co.

Manufactured by
ACME PATENT DEVELOPMENT CORP.
2680 Atlantic Ave., Long Beach, Calif.
Domestic Distributor
LIBERTY OIL TOOL CO.
P.O. Box 1548, Long Beach 1, Cal.
Export Representative
LUCEY EXPORT CORP., NEW YORK



Antenna attached to top of field foreman's car: this is hinged and equipped with a spring at the base to permit passing under obstructions. The field house is also equipped with two-way radiotelephone



Radiotelephone unit and console located at a pipe-line station. Connection with the antenna is through a coaxial cable of copper filled with dehydrated gas under pressure. Cable and terminal gage are at the rear. Reception is by loudspeakers behind the grills or by earphone. When transmitting by talking into a microphone, the receiver is shut off to eliminate internal interference

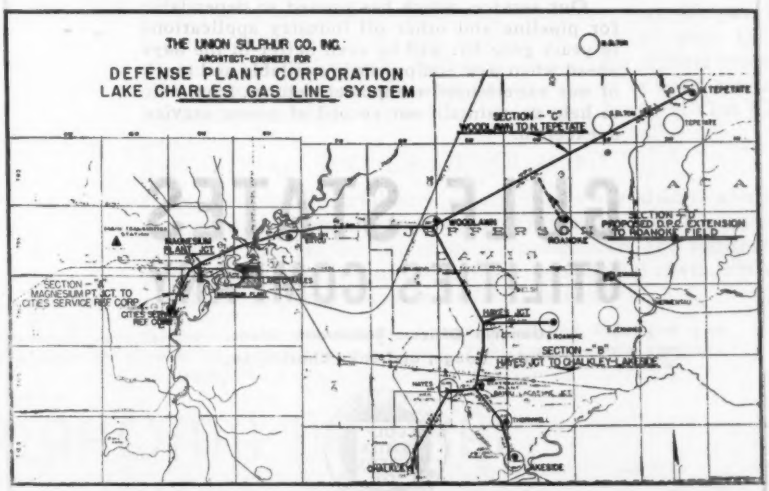
with particular problems affecting pipe-line operation was evidenced in the permission to keep the necessary station logs by means of an automatic recorder device. This obviated the writing of log entries by personnel using the system every time the various units were on the air. The main station, from which all signals going out over the system can be heard, keeps the automatic log which is filed in the main office for eventual inspection by FCC. It is believed that this is the first time that a log has been so kept, and lays the foundation for future similar situations.

Operation

The mobile units are installed in five cars. One car is used by the maintenance crew covering the whole 100 miles of pipe line. Steve Cordill, transmission engineer, and Quincy Hinton, gas dispatching engineer, each has a car; these two men have general supervision over the pipe line including the dispatching of gas, communication with the various fields from which the gas is drawn, maintenance, operations, etc. These men instruct the field foremen to open or close gas lines and wells and other routine or emergency matters. Much of this information and data is put out over the radio system. A third car is used by a tool pusher, Adam Vicent, in charge of a drilling rig in the South Roanoke field. This installation was made in order to complete the testing of the equipment within the time limit placed by FCC. The installation of a portable radio set in the bunk house at the drilling rig enables the tool pusher to keep in constant touch with the driller and it also places the gas dispatching engineer in direct communication with the South Roanoke field foreman who handles the dispatching of gas to RFC's pipe line. This installation is temporary and was made because the only source of electric power available at the field is from a steam-turbine dynamotor operated by the steam boilers at the drilling rig. Gasoline-driven dynamotors are on order and as soon as received a permanent installation will be made at the South Roanoke field office. The antenna for the set is in the bunk house on top of drilling-rig derrick. This is quite unusual and no other such deployment of a radio antenna is known in the pipe-line fields. The antenna is connected to the radiotelephone unit by means of a flexible coaxial cable. Another car is used by Joe Baker, superintendent of production, responsible for operation and maintenance of the RFC pipe line as well as production of oil and gas for Union Sulphur.

Station Locations

The main station in contact with the entire system is at the sulfur mine near the main offices at Sulphur, La. Other locations manned by pumpers, gagers, tool pushers, engineers, and field superintendents are: English Bayou; Woodlawn, oil and gas fields of the company; North Roanoke, oil field to which the RFC pipe line is now being connected; North Tepetate, oil and gas field of Atlantic Refining Co.; South



Map of pipe-line system of Union Sulphur Co., served by radiotelephone for both mobile and fixed station operation

Roanoke, oil and gas field of Union Sulphur; Lakeside, oil and gas field of the Superior Oil Co. and Grubb-Hawkins; Thornwell, oil and gas field of Cities Service Oil Co.; Bayou Lacassine Junction, dehydration plant; and Cities Service meter station where the RFC Office of Defense Plants, gas is discharged into the Cities Service refinery, butadiene, and rubber plants.

In the locations at English Bayou, Woodlawn, North Roanoke, Bayou Lacassine Junction and the Cities Service meter station the power to run the radiotelephone installations is furnished by a public electric utility, while in the remainder of the locations, except at South Roanoke, gasoline-driven generators provide the primary power.

An interesting point is the Lakeside installation. The field is totally inaccessible to any means other than over water. The use of radiotelephone there avoided the construction of a telephone line over a salt marsh, and of course, has expedited all communications with the field.

Radiotelephone Operation

An average of over 200 calls are placed over the system daily, and during one emergency, when Cities Service Refining Corp. was shut down by a strike, over 300 calls were handled by the system without hitch. Extra-heavy batteries and generators in the cars keep the primary power charged and available for the extra load which the operation of the radiotelephone system placed on the vehicle battery. There has been no trouble with rundown car batteries.

The operation of the equipment is unusually simple. Every unit functions much along identical lines whether it be the portable, mobile, or main station model. Pressing a button on the microphone handle causes the set to be placed in transmitting operation while releasing it permits incoming signals to be heard.

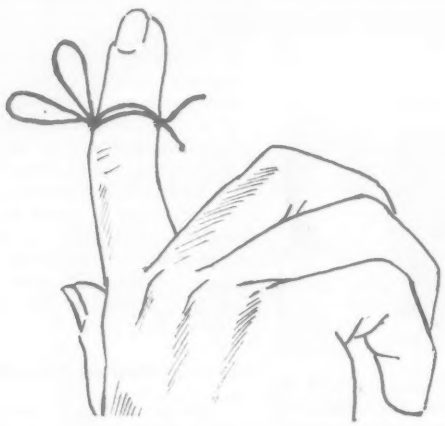
The operator located at the main station is responsible for automatically recording each conversation that comes over the system. She announces on duty at the time she starts work and off duty when she quits work. The operator relieving her does the same thing. Of course, they give their names, time, station, and other data required by FCC. Each operator that uses the system holds at least a restricted radiotelephone license. The operator at the end of her tour of duty removes and files the record and puts a new one on the machine. She signs the gummed label in the center of the record as part of the log.

The use of f.m.-type transmission and reception has had many advantages. Not only are the atmospheric effects (static) reduced to a minimum and communications maintained even through the heaviest electrical storms, but the many public-utility high lines do not interfere with the system either. Signals are received loudly, clearly, and distinctly over the entire network. This permits its use the same as an ordinary telephone.

It has been found that the radiotelephone - communications system operates much faster than any other type, and in some instances the operators are using it in preference to telephone because of the feature of direct connection with headquarters. Actually, there were only three stations where previous telephone connections were available, while at seven locations the only means of communication was by means of word-of-mouth passed by personnel operating an automobile. This has now all been unified under the one radiotelephone communications system.

Dies of pipe wrenches should be kept clean. Accidents have occurred too often as a result of dirty wrenches slipping off pipe.

It has been found to be bad practice to have screw drivers sharpened to a knife edge for such tools frequently slip from grooves of screws.



Something to Remember...

When the chips were down and any delay could be disastrous, Gulf States electric power did not fail the men of the oil industry.

That's something to remember now that we are all producing again for peace.

Our service, which has proved so dependable for pipeline and other oil industry applications in years gone by, will be even better in the days ahead when new equipment is available and much of our experienced manpower returns from war to help us maintain our record of power service unexcelled.

GULF STATES
UTILITIES COMPANY

General Offices: Beaumont, Texas,
Baton Rouge, and Lake Charles, La.

DEPENDABLE GULF STATES UTILITIES CO PUBLIC SERVICE

Natural Gas For Industry Costs *Less* In OKLAHOMA!

The abundant supply, availability and low cost of natural gas for industrial uses is an important factor in present and postwar development of Oklahoma. Supplementing the adequate transportation facilities, natural resources and stable labor conditions this low cost fuel has attracted many industrial and manufacturing plants to the state.

DEPENDABLE SOURCE AMPLE RESERVES

Connected with many widely separated gas fields, Oklahoma Natural Gas Company assures its customers a dependable source of low-cost fuel and ample reserves. The 240 company owned gas wells which supply 20% of its requirements are supplemented by purchased gas from more than 300 wells in dry gas fields, oil fields and from gasoline plants.

5000 MILES TRANSMISSION AND DISTRIBUTION SYSTEM

The company's system includes some 5000 miles of transmission and distribution lines; serves 700,000 people in 100 communities in Oklahoma.

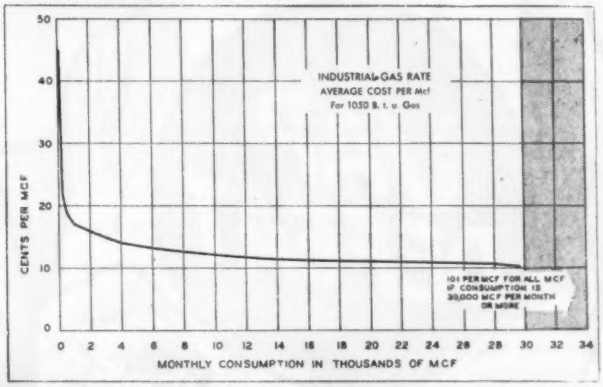
SERVES MANY CITIES— INDUSTRIAL CENTERS

The company serves approximately one-third of Oklahoma's population; supplies approximately 60% of all the natural gas consumed in the state.

The following Oklahoma cities over 10,000 population (1940 census) are served by Oklahoma Natural Gas Company:

Oklahoma City	204,400
Tulsa	142,200
Muskogee	32,300
Enid	28,100
Shawnee	22,100
Ardmore	16,900
Okmulgee	16,100
Sapulpa	12,200
Norman	11,400
El Reno	10,100
Stillwater	10,100

LOW INDUSTRIAL RATES


INDUSTRIAL GAS RATE
AVERAGE COST PER Mcf
For 1030 B. t. u. Gas
CENTS PER MCF
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34
MONTHLY CONSUMPTION IN THOUSANDS OF M.C.F.
10¢ PER M.C.F. FOR ALL M.C.F. IF CONSUMPTION IS 30,000 M.C.F. PER MONTH OR MORE

The company's Industrial gas rates compare favorably with other Southwestern areas, providing a source of fuel adapted to industrial use at lowest cost, and other economies in plant operation. Automatic control of temperatures, steam pressure and furnace atmospheric conditions, possible through use of natural gas, make skilled operating labor unnecessary.

NOW SERVING STATE'S MAJOR INDUSTRIES

The versatility, efficiency and economy of Oklahoma's natural gas is reflected in the importance and diversity of the major industries already served by Oklahoma Natural Gas Company, including: brick, tile, cement and glass plants, oil refineries, cotton gins and cotton oil plants, ice, water pumping and electric power plants, steel and metal working plants, aircraft manufacturing plants, chemical and food processing plants, meat packing plants, zinc smelters, railroad shops and many others.

RESIDENTIAL AND COMMERCIAL RATES

Most residential and commercial customers pay 45c per 1000 for first 100,000 cu. ft. per month; 18c for all over 100,000 cu. ft. in any one month. Although one of the richest states in oil and coal deposits, little or no oil or coal is used for heating in communities served by Oklahoma Natural Gas Company.

INDUSTRIAL SERVICE DEPARTMENT

Our staff of industrial service engineers are always available to manufacturers and industries. Our engineers and specialists have developed many new applications for natural gas appliances. Analysis of requirements and fuel costs is always available to prospective industrial customers.

The management of this company urges your serious consideration of Oklahoma's multiplied industrial and manufacturing advantages, and pledges its earnest cooperation in every way. Your inquiries are cordially solicited.

OKLAHOMA NATURAL
Gas Company

General Offices: 624 South Boston Ave., Tulsa, Okla.

Pipe Liners—
You've done a great job!

You Pipe Liners had a big job to do and you did it.

On Pearl Harbor Day, the call went out for "More Oil". Pipe Line operators everywhere tightened their belts and kept oil flowing at an ever increasing pace until the day final victory was won.

For the job Pipe Liners turned in, the World is thankful.

We're proud of our job, too—

The electric power industry kept pace with the Pipe Line operators all through the difficult war-time emergency period. The availability of additional electric power for added pipe line loads and the dependability of electric service made it possible for pipe lines to take on capacity loads over-night and keep the oil moving.

Pipe Line operators in the service area of Texas Electric Service Company are invited to call on our engineers for aid in the solution of their peace-time power problems just as they did during war-time.

TEXAS ELECTRIC SERVICE COMPANY

Pumping-Station Power Service Is Improved by Capacitors

by M. A. Hyde, Jr. and R. E. Marbury

A SERIOUS problem in voltage regulation occurring in connection with starting a large pumping motor on the end of a light transmission line was solved in an unusual manner with a capacitor supplied through an autotransformer. At Roxboro, N. C., is a pumping station on the 8-in. extension of the Plantation pipe line. The single centrifugal pump at this station is driven by a 600-hp. two-pole, squirrel-cage motor rated at 2,300 volts. Three-phase, 60-cycle power is supplied over a 12.4-kv. line of No. 2 copper about 19½ miles long. Normally this line carries a peak distribution load exclusive of the pumping station, of about 444 kw.

It was anticipated that the starting current of this motor might reduce the voltage at the motor terminals to a value less than would provide the necessary starting torque. Starting-torque test data on the motor and the pump, when the line is carrying its densest liquid (fuel oil of 0.867 specific gravity) is given in Fig. 1. From this it is evident that for the motor to have a safe margin of torque during starting, the voltage at the terminals must not be less than 1,760 volts. Calculations showed that if the motor was started in the usual manner the voltage would drop to 1,388 volts, assuming no other load on the feeder, and a sending-end voltage of 2,530 volts. With this deficiency of 1,760-1,388 or 372 volts, the motor obviously would not be able to accelerate the pump to full speed.

Alternative line facilities were considered, but were not permissible from the standpoint of critical materials conservation. The power company, however, agreed to serve the pumping station over this circuit and to deliver a minimum voltage of 1,760 during starting, provided a two-section capacitor be installed at the pumping station

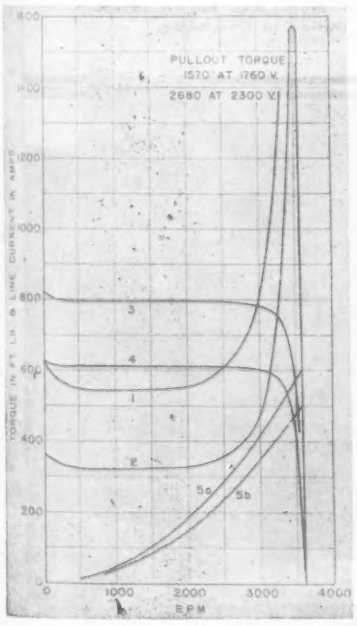
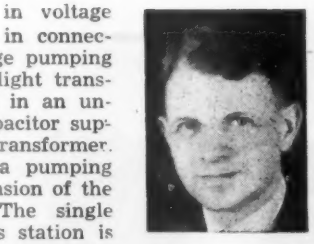


Fig. 1—The starting characteristics of a 600-hp. pump drive on the 8-in. petroleum-products line are shown as follows: (1) Speed torque at 2,300 volts, (2) Speed torque at 1,760 volts, (3) Speed current at 2,300 volts, (4) Speed current at 1,760 volts, and (5) Speed torque for starting with pump discharge closed and pumping fuel oil and gasoline



M. A. HYDE, JR.

R. E. MARBURY

Merritt A. Hyde, Jr., has been a member of the headquarters engineering department of Westinghouse Electric Corp. at East Pittsburgh ever since graduation from Case School of Applied Science, specializing for the past decade in petroleum-industry electrification. He is well known in pipe-line circles. His recent activities include service as electrical consultant on Plantation Pipe Line, as Westinghouse engineering coordinator on the big inch and little big inch lines, and as a member of the group of engineers who designed the station control system for the 20-in. products line.

R. E. Marbury joined Westinghouse Electric Corp. staff in 1917, and became section engineer in charge of capacitors in 1929. In 1930 he was appointed assistant manager of the supply engineering department, and in 1931 was promoted to the position of manager of that department. Since 1934 he has been section engineer in charge of capacitors in the switchgear engineering department. He received his engineering training at Georgia Tech and Carnegie Tech.

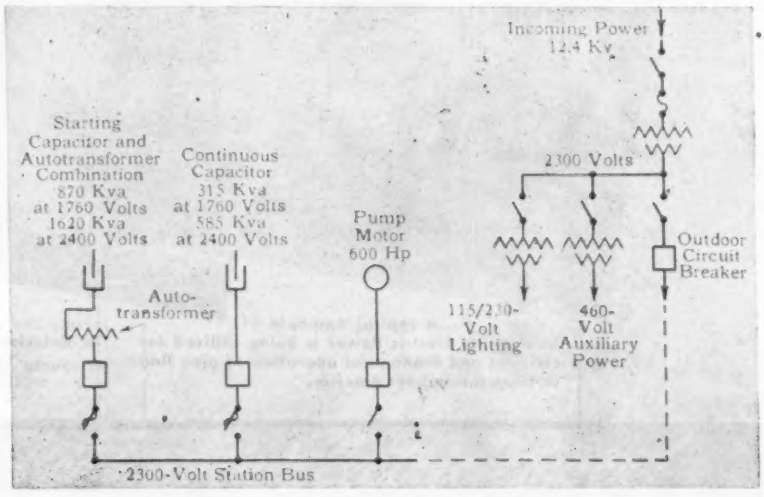
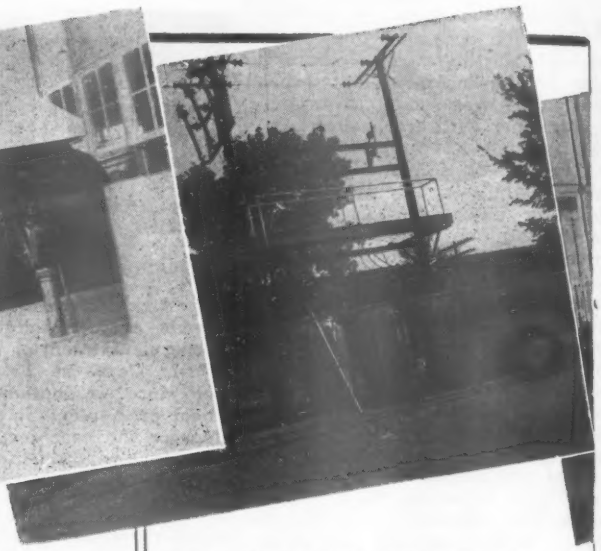


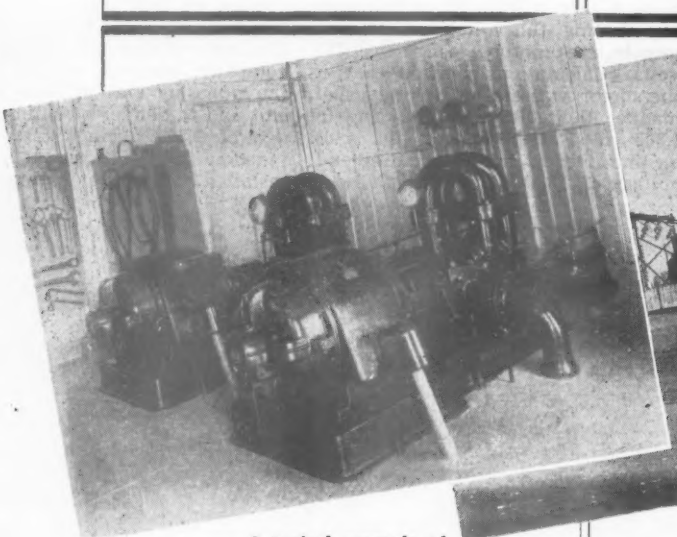
Fig. 2—Schematic layout of the starting and continuous capacitor and the autotransformer connections to the station bus

Power That keeps

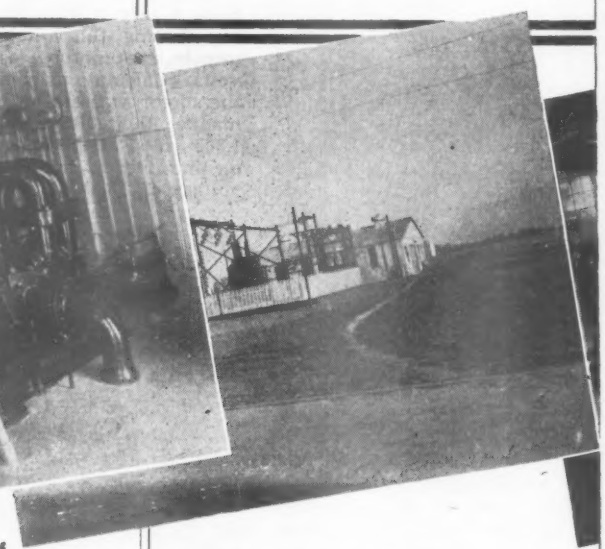
A typical installation of motors and ventilating air ducts of a WEP 20" products line station.



A transformer bank and transmission line to a main line major company pumping station in Oklahoma.

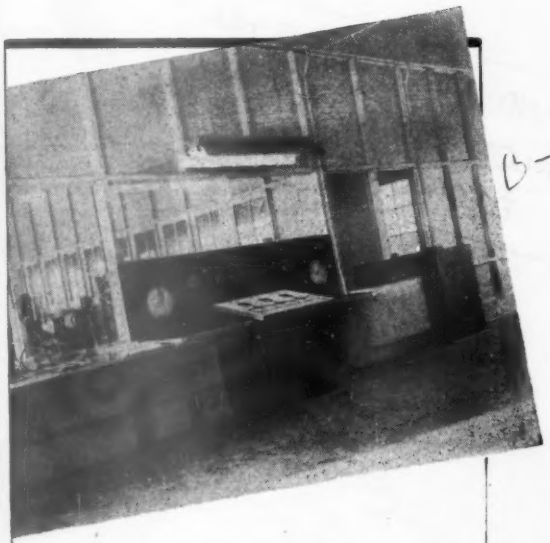


A typical example of how Utility Electric Power is being utilized for efficient and economical operation of pipe line stations throughout America.



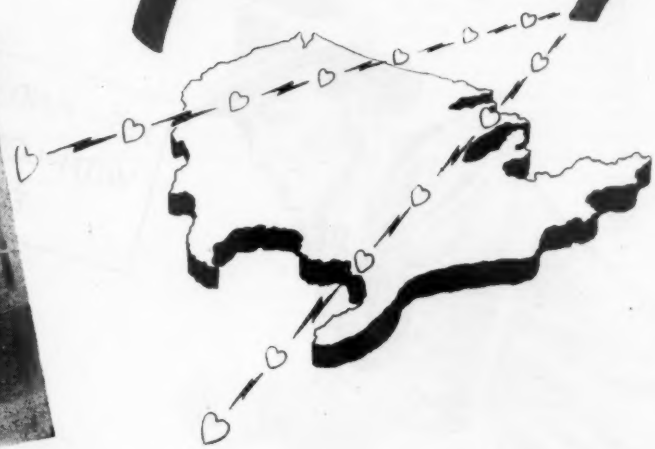
Exterior view of a WEP 24" crude oil pump station.

the nation's pipeline *Pulsing*



The control desk with a view of the pump room through the glass partition in a WEP 20" products line station.

Pipe line stations like one above are delivering thousands upon thousands of barrels of oil and gasoline daily to vital points of distribution at rock-bottom costs.



The expansion of the nation's great pipe line systems will not stop with peace. Instead, there will be an ever-increasing demand for pipe lines, because it has been plainly established that they are economically sound for the transportation of petroleum products.

One of the chief factors which make pipe line transportation more economical is the fine service afforded by UTILITY ELECTRIC POWER. There are many advantages, among them being *Lower Capital Investment, Less Maintenance, Down Time Reduced, Simplicity, and Flexibility of Operation.* As proof of its ability to do the job, UTILITY ELECTRIC POWER leads all other types of power in the operation of the nation's pipe line systems. Not only is its performance outstanding, but it has set remarkable records for economy as well.

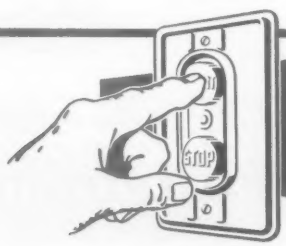
When you plan your pipe line stations, be sure to investigate UTILITY ELECTRIC POWER. Use the POWER THAT KEEPS THE NATION'S PIPE LINES PULSING!

Utility ELECTRIC POWER

Use Utility Electric Power!

PETROLEUM ELECTRIC POWER ASSOCIATION

For the very best production results, tackle every job with low-cost dependable electric service . . . the power that has proved its advantages in every field. Whatever your power needs may be you'll find that electric service is not only economical but it gets the job done regardless of size.



HOUSTON LIGHTING & POWER COMPANY

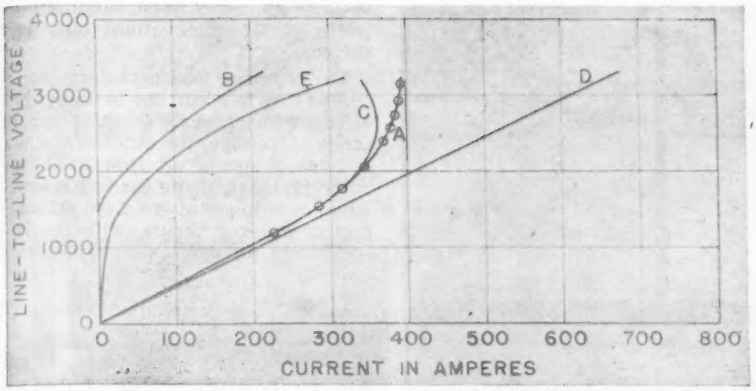


Fig. 3—Volt-ampere characteristic curves for capacitor-autotransformer combination plotted from test data and showing: A—Total current input to combination; B—power-component current; C—wattless-component current; D—capacitor current (input side), and E—autotransformer magnetizing current (D — C)

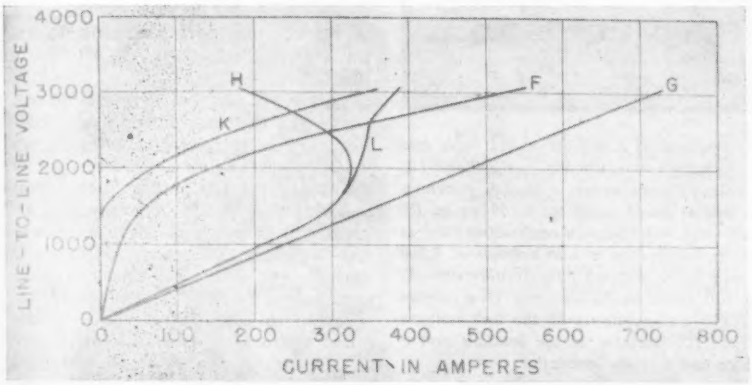


Fig. 4—Volt-ampere curves for combination of standard 2,400-volt capacitor and double autotransformer plotted from calculated data. The autotransformer magnetizing current is shown in F, the capacitor current (input side) in G, the wattless component current (G — F) in H, the power-component current in K and total current input (K + H) in L

bus, as shown in Fig. 2. With both sections energized during the starting period the total bank was required to provide a capacitive effect of 1,185 kva. at 1,760 volts. In arriving at this value of capacitor, it was assumed that simultaneously with the motor-starting demand there would also exist on the feeder 80 per cent of the distribution load, or 355 kw. at 0.80 power factor.

After completion of the motor-starting period, one section of the capacitor is switched off, leaving an effective capacitor kva. of 650 at 2,530 volts, this being the calculated voltage attained with this continuously operating capacitor and the motor running at full rated load, and with 20 per cent distribution load. This amount of continuous capacitive kva. (650 at 2,530 volts) was obtained by using a standard 2,400-volt capacitor of 585-kva. rating.

Because the required total effective capacitive kva. at 1,760 volts must be 1,185, of which 315 are obtained at this voltage from the continuous-running capacitor, the difference (870 kva. at 1,760 volts) must be provided by the second or starting capacitor. This section, being in service only during starting of the pump motor, was designed for intermittent operation.

The capacitors adequately cared for the problem of undervoltage during the early acceleration period, but themselves led to an equally serious problem of excess voltage late in the starting cycle. At the end of the motor-starting cycle, when the motor approaches full speed, its starting current suddenly decreases to a low value, leaving a large net capacitor current on the bus until the starting capacitors can be tripped off. This results in an increase in voltage at the bus, which in turn increases the capacitor current, and this further increases the voltage, the condition stabilizing at a value calculated as about 3,200 volts. This overvoltage would be excessive, accelerating lamp burnout, particularly for those lamps near the end of normal life.

Consideration was given the possibility of reducing the overvoltage by removing the starting capacitor as soon as the motor reaches a speed where this capacitor is no longer necessary. This could be done by relaying responsive to change in motor power factor or impedance. However, the capacitor is required until the unit is well up to full speed, after which acceleration is extremely rapid because of the low inertia of the motor and pump and the suddenness with which the motor torque increases after passing the critical range. While such relaying would limit the duration of overvoltage to a fraction of a sec-

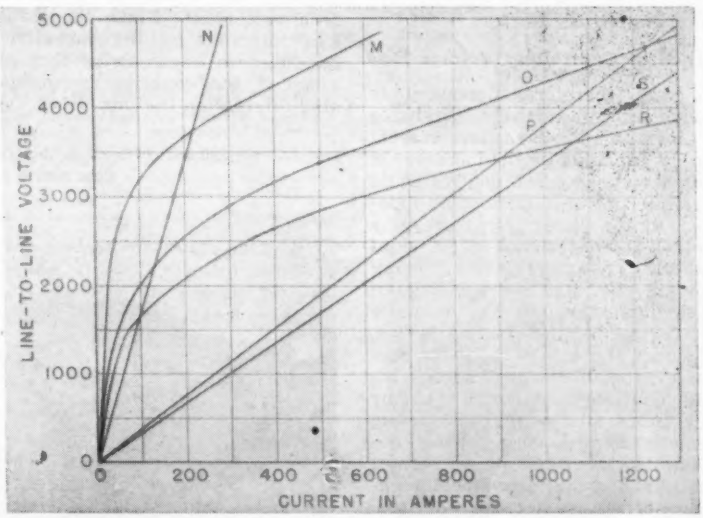


Fig. 5—Curves showing the self-excitation characteristics for 600-hp. motor and capacitors under the following conditions: M—excitation current for one motor; N—capacitor current for continuous capacitor; O—excitation current for one motor plus single autotransformer (M + E); P—capacitor current for test capacitor plus capacitor current (D + N); R—excitation current for one motor plus double autotransformer (M + 2E); S—current for the intermittent capacitor (G + N)

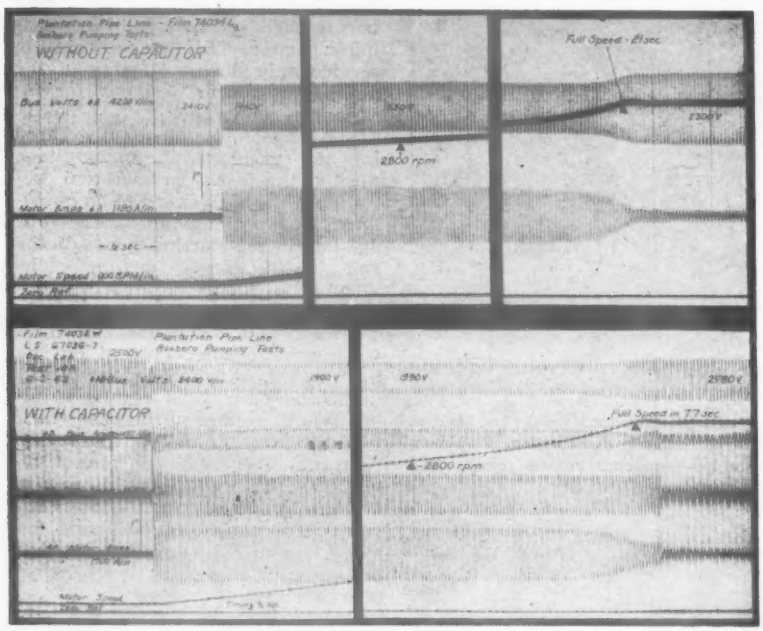


Fig. 6—These oscillogram sections show the performance of a 600-hp. motor, with and without capacitors, in the Roxboro station test. Without capacitors the bus voltage (A) is reduced from 2,410 before starting to 1,440 volts. Where motor is started acceleration is relatively slow, and the flatness of the motor speed curve at 2,800 r.p.m. (B) shows that the excess of motor torque over load torque is slight. Accelerating time is 21 seconds (C). A later test with the capacitors in service on a bus voltage of 2,500 with no station load, showed a drop to 1,900 volts upon starting (D). Acceleration (E) is considerably more rapid, and the unit attains full speed in 7.7 seconds. Overvoltage at the end of the starting cycle is imperceptible. The bus voltage with the unit running (E) is slightly higher than the no-load bus voltage (D) because of the leading power factor of the combined load of motor and running capacitor

ond, this overvoltage would occur each time the motor is started. Even these brief voltage peaks would be undesirable from the standpoint of service to the pipe line and to other customers on the line.

Method of Controlling Voltage Rise

It was, therefore, necessary to provide some means of neutralizing the increase in capacitor current that is inherent with increase in applied voltage. Such control could be effected by introducing, in opposition to the capacitive current, a reactive current small in value at the low voltage existing during most of the starting period, but large when the voltage increases near the end of the starting period, to balance the excess capacitor current at the higher voltage. This could have been accomplished by using in parallel with the starting capacitor an iron-core reactor designed to saturate at a voltage slightly above that at which the capacitor effect is primarily desired.

The method actually used was to supply the starting capacitor through an autotransformer, as shown in Fig. 2. This served two purposes. It provided the necessary lagging current when needed and in addition decreased the size of the capacitor required. An autotransformer ratio was chosen such that a voltage 1.4 times bus voltage was impressed across the capacitor bank, which consisted of standard 2,400-volt units. Thus, the leading kva. supplied by the capacitor is increased to about twice that provided if the capacitor were operated directly on the bus. Such overvoltage operation is permissible because of the intermittent duty on the capacitor.

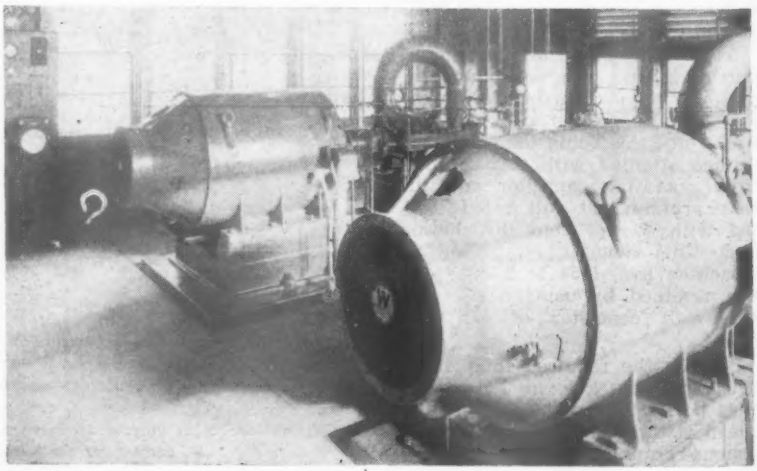
To provide the necessary controlled reactive current to limit the effect of the capacitor in the upper range of voltage, the autotransformer was designed so that at 1,760 volts the magnetizing current is low, while at voltages above 2,400 saturation of the iron occurs, with resultant sharp increase in lagging current.

Tests Check Installation Theory

To verify the theory of the proposed installation careful tests were made in the factory laboratory. This included a no-load saturation test on the 600-hp. motor, carrying the readings up to voltages 200 per cent of normal. The proposed combination of capacitor and autotransformer likewise was fully tested, a series of oscillograms being taken for which the results are shown in Fig. 3.

The volt-ampere characteristic curve for the combination of capacitor and autotransformer is shown in Curve A. From each test oscillogram the input power factor was calculated and the total input current was separated into its power and wattless components, Curves B and C, respectively. The net volt-ampere curve for the test capacitor referred to the input side of the autotransformer, is shown in Curve D. This is a straight line, obtained by actual measurement of the capacitance of the capacitor (5.88 ohms, line to neutral) then deducting the series reactance of the autotransformer to obtain a net resultant capacitance for the combination. The value obtained, referred to the low side of the autotransformer, is 2.83 ohms per phase, line to neutral. For a line-to-line voltage of 2,400 on the low side, the corresponding

Fig. 7—Two 900-hp., 3,385-r.p.m. motors driving 12-in. products line pumps, in intermediate station of Plantation Pipe Lines



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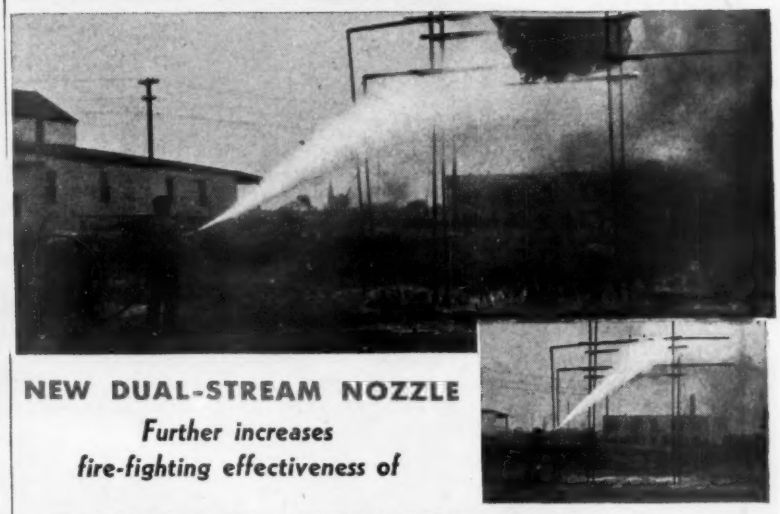

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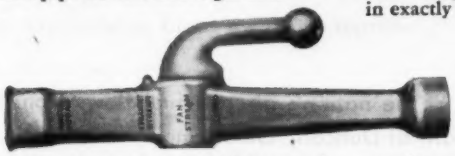

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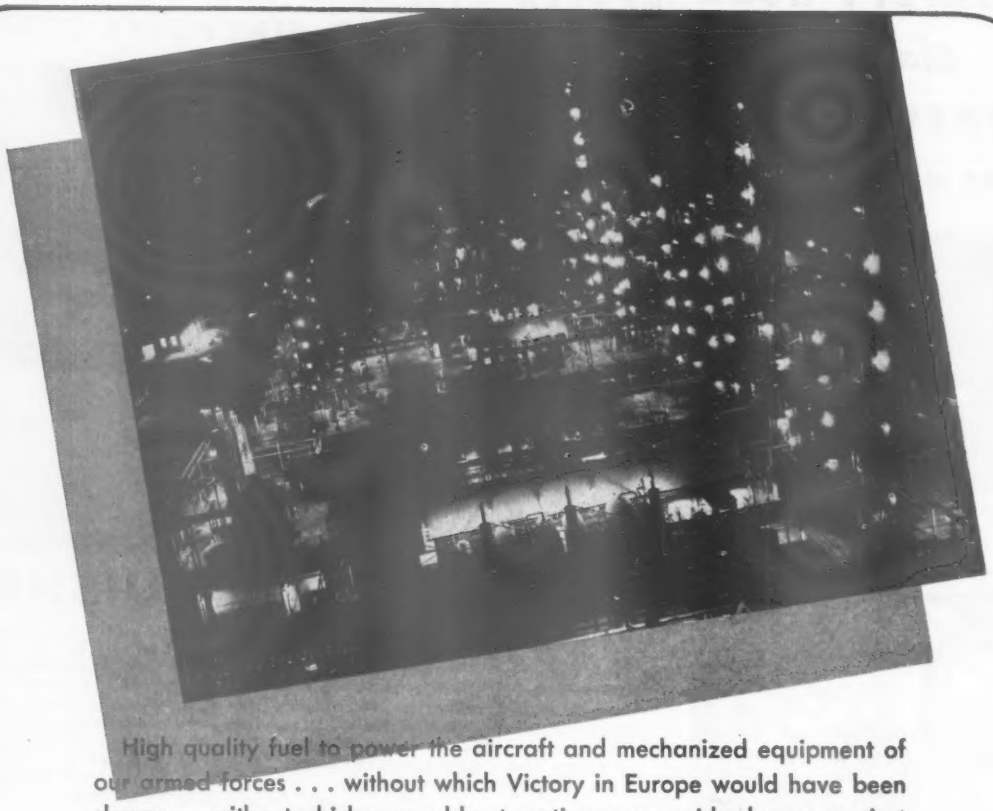

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current is 490 amp. Plotting these two values determines the effective volt-ampere curve for the test capacitor.

The net reactive current, Curve C, is the resultant of the leading reactive current of the capacitor, Curve D, and the lagging magnetizing current of the autotransformer; hence, the latter is obtained by subtracting the current values in Curve C from those on Curve D, giving Curve E.

As the voltage increases and saturation of the autotransformer occurs, the magnetizing current drawn by the autotransformer assumes disproportionately greater values, neutralizing to an increasing extent the capacitor current and finally, at about 2,700 volts, causing a decrease in the total reactive current.

This effect, of course, can be increased by increasing the magnetizing current of the autotransformer. In Fig. 4, Curve F is a magnetization characteristic calculated for two autotransformers identical with the one tested, connected in parallel to the capacitor.

Capacitive Reactance

The capacitive reactance of the capacitor bank alone is 4.92 ohms, line to neutral. The series reactance of the autotransformer is now half the value previously used. The resultant effective capacitive reactance referred to the low side is 2.44 ohms, line to neutral. For a line-to-line voltage of 1,760 on the low side, the phase current is 416 amp. These two values determine Curve G. In this curve the voltage value and the current value are referred to the low-voltage side of the autotransformer.

At 1,760 volts the magnetizing current drawn by the autotransformer bank is 98 amp., leaving a net effective capacitive current of 318 amp., or 970 bank kva. at 1,760 volts. This approximates the 312 effective amperes for the test capacitor. Either capacitor bank provides about 10 per cent margin of effective capacitive current at 1,760 volts, above the minimum requirement for the intermittent capacitor.

Curve H is the total reactive current for the combination and is obtained by subtracting the current values of Curve F (transformer magnetizing current) from those of Curve G (capacitive current). The power-component current, Curve K, is constructed by doubling the power-component currents obtained in Curve D, Fig. 3, for a single autotransformer. Finally, the total current, Curve L, is obtained by combining the power-current Curve K and the total reactive-component current Curve H.

Next, consideration was given to the self-excitation voltage possible with the capacitor banks and the motor connected to the pumping-station bus, the motor at ful speed and the bus isolated from the power

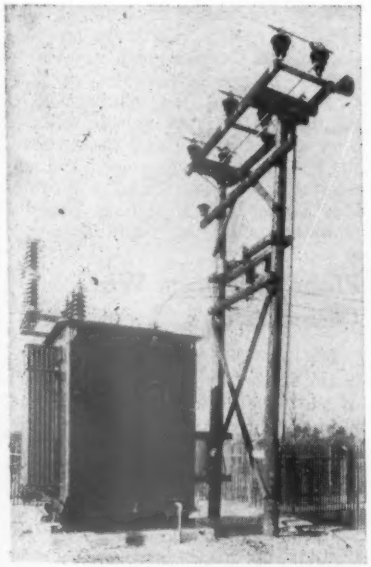
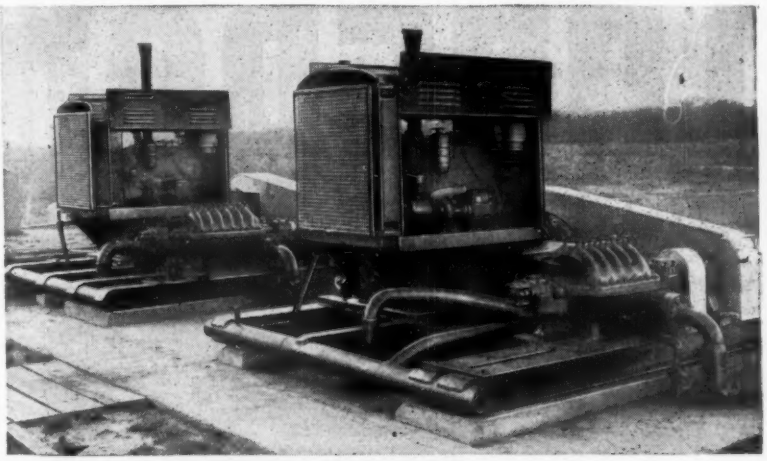


Fig. 8—Minimum use of substation construction materials features this substation with completely self-protecting transformer, serving pumping station on Plantation Pipe Line



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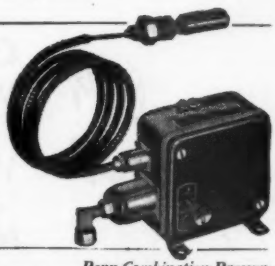
Magneto Ignition Applications. Sounds an alarm only . . . grounds dual magneto . . . grounds magneto only . . . grounds magneto and sounds an alarm or lights a signal light.

Dual Ignition Applications. Opens battery circuit and grounds magneto.



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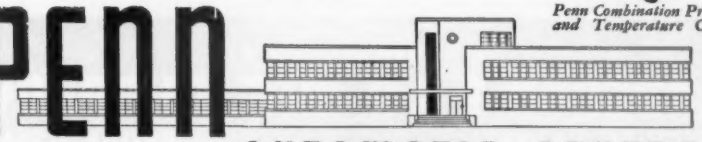

AUTOMATIC CONTROLS

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supply by tripping of the main breaker. Two operating conditions must be considered: (1) In normal running operation the 585-kva. running capacitor is connected to the bus with the motor; (2) during starting both capacitor banks are in use, and self-excitation can occur with this combination at full motor speed at the end of the motor-starting cycle

Predicting Self-Excitation Voltage

Consider first the running condition. The maximum self-excitation voltage with no-load on the station bus can be predicted by finding the value at which the no-load excitation curve for the motor intersects the volt-ampere characteristic of the continuous capacitor. As shown in Fig. 5, Curves M and N, this occurs at about 3,750 volts.

Considering the starting condition, the combined magnetization curve for the motor and test autotransformer is Curve O, and the volt-ampere characteristics of the effective test capacitor plus the running capacitor is Curve P. Their intersection occurs at about 4,750 volts. The combined magnetization curve for the motor and two autotransformers, Curve R, intersects the volt-ampere line of the combined intermittent capacitor plus the continuous capacitor, Curve S, at about 3,600 volts. In practice these values are decreased by the loading effect of the losses in the autotransformer feeding the intermittent bank.

Oscillograph Tests at the Station

Having verified the scheme and determined the practical autotransformer proportions by laboratory test, the installation was made, and field tests of the installed equipment conducted with an oscillograph, to check the performance of the apparatus under service conditions. These tests showed:

1. Without the capacitor the station-bus voltage during starting is inadequate (1,530 volts with motor at 2,800 r.p.m.) With the two capacitor sections in service the bus voltage is ample (1,990 volts).

2. At the end of the starting cycle before the intermittent capacitor section is disconnected, the station bus voltage is held to about 105 per cent of its no-load value.

3. With both capacitor sections and the motor connected to the station bus, and the bus isolated from the outside power supply after the motor has been brought to full speed, the self-excitation voltage attains a value of only 2,910 volts, about 125 per cent of motor rating. Conditions did not permit measurement of the self-excitation voltage without the autotransformer, but the predicted value for such a combination with no other load on the bus, is in the order of 7,500 volts.

This combination of saturating autotransformer and capacitor has been in satisfactory operation at Roxboro station since June 1943. In this case a motor operates in combination with a relatively large capacitor—the capacitor kva. at rated motor voltage being four times the motor kva. Yet, the installation has handled effectively the problem of overvoltage at the end of the starting cycle, and has reduced the self-excitation voltage from a prohibitive value to one that is practical from an operating standpoint.

Floor Markings Warn Of Stairways

During overhauling of pumping units and other operations material of various kinds is carried through station buildings. Accidents have sometimes resulted from the failure of employes to notice when they were approaching a stairway or a single step, obscured either by the material being moved or by the fact that it be necessary for them to walk backward while carrying. As a safeguard some companies paint a large red disk on the floor near each stairway. Single steps have been prominently marked with slanting black-and-white stripes.

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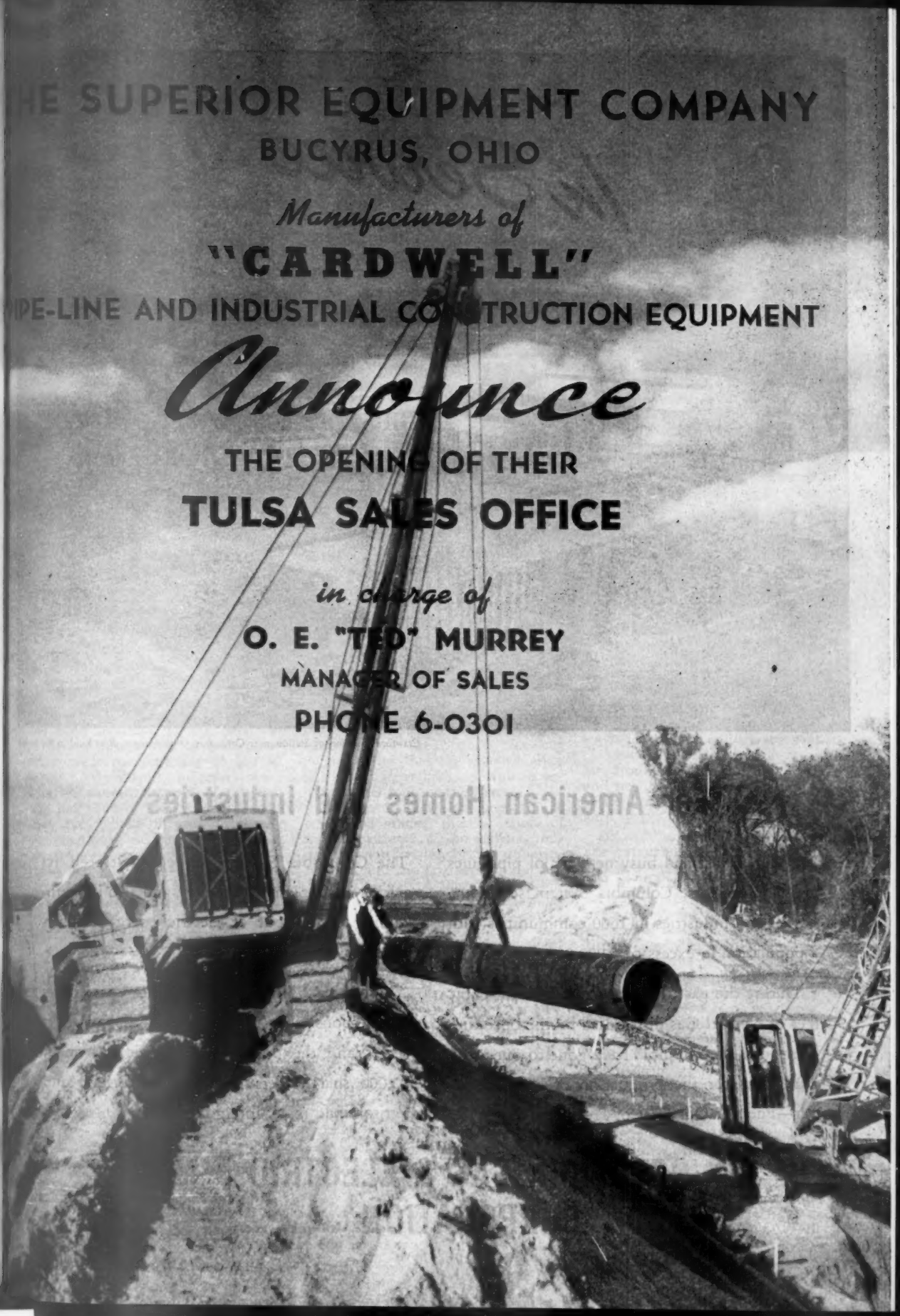
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Hydraulic Testing of a Crude-Oil Pipe-Line System

by J. Marston Linehan

THE hydraulic or water-pressuring method of testing has demonstrated its value when properly applied to meet the needs of a pipeline system for detecting weak points ahead of the time they will give trouble. In this way repairs can be made thoroughly and economically with a result that throughput can be increased and maintenance costs reduced to a marked extent.

Briefly the procedure is as follows: (1) Make all repairs possible while the line is in service; (2) displace oil with water and drain; (3) replace badly corroded sections, repair and remove old fittings; (4) refill the line with water and apply pressure tests at 800 to 1,200 lb., depending on the size and operating requirements of the particular section of line; (5) pressure tests and repairing are continued until the desired pressure can be held for 24 hours.

Before pressuring was started as a regular procedure of the company 8 years ago, operating pressures averaged between 400 lb. and 650 lb. on most lines. Since pressuring has been adopted, it has been regarded as practicable to raise operating pressures generally to 800 lb. Since pressuring policies were adopted the throughput of the system has been greatly increased over that for which it was originally designed. Furthermore, in addition to reduced maintenance expense, there have been the numerous advantages resulting from reduction in shutdowns, damage claims and in the attention required for line walking.

By water pressuring, the reliability of the line can be tested after making obvious repairs. This can be done without entailing the large expense of uncovering several miles of pipe for visual inspection which may fail to disclose certain important weak points.

Repair Program

Hydraulic testing is applied as a part of a general line repair program in which the obvious weak points in the line are repaired by welding or cutting out collars, by spot welding of pits and by replacement of badly corroded sections of pipe. The water pressure test is effective as an economical method for locating any weak points in the line which could not be located by customary inspection methods. As a result of the precautions taken in water pressuring by which: (a) pressure is increased gradually so as to avoid surges, and (b) maximum test pressures are not allowed to exceed those which the line should withstand with a reasonable margin of safety under service conditions. The test does not break good pipe but demonstrates that the repaired line is sound and reliable for future requirements for several years.

Testing with water pressure is conducted under the direction of foremen in each of the districts, under the supervision of the superintendent and the engineering department. In general the foremen follow the same procedure. Methods vary somewhat because of the need for being ready for interruptions when the use of the line is required.

In preparing for a test, the usual practice is to disconnect all branch lines and displace the oil with a scraper. After the scraper has been removed, the line is cut. A cap is welded over the end of the section of pipe to be tested. For venting air from the line a ¼-in. nipple and needle valve are installed close to the end of the line. Later a pressure gage is placed here.

All saddles and collar-leak clamps are removed. Known leaking collars are welded or cut out, visible pits in the pipe are spot welded at certain points where the pipe has been uncovered. Where corrosion is excessive, bad pipe is replaced entirely. Replaced sections of sound pipe are protected by primer, hot asphalt coating and asbestos wrapping. It is often possible to utilize part of the pipe removed for gravity lines. Special attention is given to replacing pipe where it is obvious that pipe is badly corroded, particularly at locations where the soil has been saturated with salt water.

Two pumping units are preferable for the testing operation: one to fill the line, having 4-in. or 5-in. liners and pistons; the other with 2½-in. liners and pistons to raise pressure from the vicinity of 400 lb. to the higher test pressures. When two units are not available,

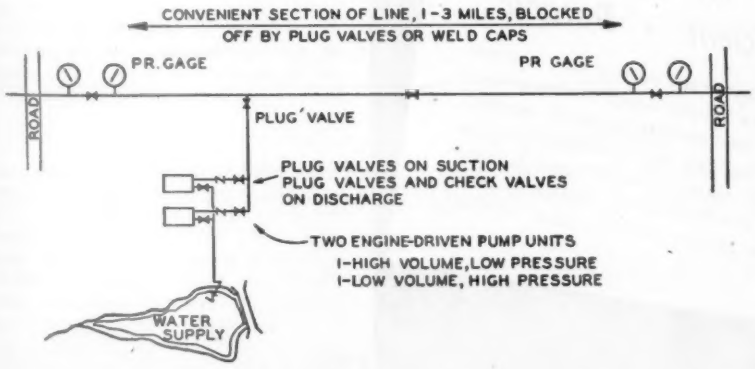

Diagram of pumping equipment, valves and gages for water pressure test of a repaired section of pipe line

J. Marston Linehan, vice president and general manager, Mid-Continent Pipe Line Co., was born in Ohio, and went to high school at Bartlesville, Okla., where his father was division superintendent of Prairie Pipe Line Co. On conclusion of studies at St. Benedict's College and St. Mary's College, he was a scout for Barnsdall Oil Co. In 1921 he started 12 years' service with Prairie Pipe Line Co. in various capacities including those of inspector, gager, chief tank strapper, and chief gager. In 1932 he was special representative of Consolidated Pipe Line Co., a Sinclair subsidiary. Service with the Mid-Continent Pipe Line organization started in 1933 when it was known as Cosden Pipe Line Co. From his first position of superintendent of the southern division, he was promoted to assistant general superintendent in January 1939; he became general superintendent in October 1941. On April 27, 1944, he was appointed vice president and general manager.

as frequently is the case, one unit is used. But in this event there is some inconvenience and loss of time when liners are changed while going from lower to the higher pressure operation. The unit may be a 2½-in.-5-in. by 10-in. pump, with a special set of high-pressure 2-in. liners, mounted on a truck with power takeoff or it may be a unit of approximately the same size on skids.

In order to accomplish the objective for which the test is intended, pressure should be applied gradually above 400 lb. In this way pressure surges can be avoided that would split some pipe which, if properly tested, would stand the maximum operating pressure to which the line would be subjected.

When applying water pressure with careful attention to the elimination of surges, it has sometimes been found that joints have split when pressure was as low as 500 to 600 psi. Under visual examination this appeared to be good pipe. Previously the section of the line had been operated at lower pressures. By eliminating such weak points it was safe to operate at higher pressures.

A measure which is important for obtaining satisfactory results from a water pressuring program is blocking off the line in 2-mile to 5-mile sections by means of high-pressure plug valves. Early experience in water pressuring of pipe lines showed that testing longer sections was impractical since operations could not be properly controlled.

A record of all collar-leak clamps and saddles is kept on inventory maps at the field offices. Bad pipe is located by a survey made before repair work begins.

When testing and repairing a line or a group of lines, the foreman furnishes the management and the engineering department with a summary of the work which shows when the lines were examined, the date the work started and stopped, the final test pressure and date and any other pertinent data.

The repair program immediately preceding water pressuring also has included replacing pipe at road crossings and installing casing there. It had been found that corrosion often occurred at uncased road crossings. Creek crossings have been placed aboveground wherever possible. Over creeks the pipe is usually suspended by cables.

Corrosion of such cables at the surface of the ground is eliminated by having the cable connected to the dead man by a steel arm and turnbuckle.

Where soil conditions are bad, pipe is sometimes supported aboveground on "H" frames. There is trouble with expansion and contraction of pipe if such sections are too long.

In reviewing the results of water pressuring after repairing, it is found that reports from all districts show there have been no major leaks after such testing. What leaks occurred have been few and small. Water tested sections frequently develop no leaks for 3 or 4 years.

The continued application of water pressuring has given assurance of the effectiveness of the company's revamping and repair program which has benefited the entire system by making it possible in an economical way to progressively handle the larger loads which have been required in recent years.

During construction of China line an area near Kaimang was inundated by 4 to 6 ft. of water. The pipe could not be coupled together in such a lake. Unphased, the pipe liners coupled together 600-ft. lengths of pipe, plugged the ends to make the sections float, and towed them into place to be coupled with other similarly built sections. Several miles of the pipe line were coupled in this way.

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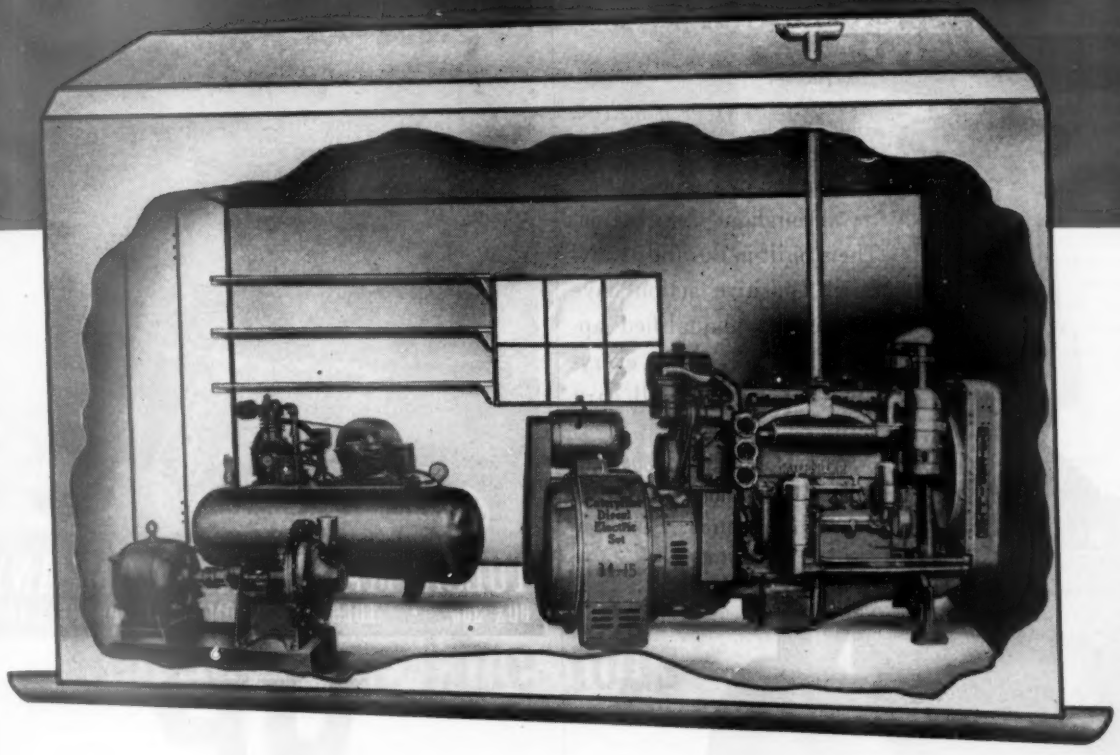

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3. Air compressor tank-mounted with 5 HP Motor; belt driven to compressor.

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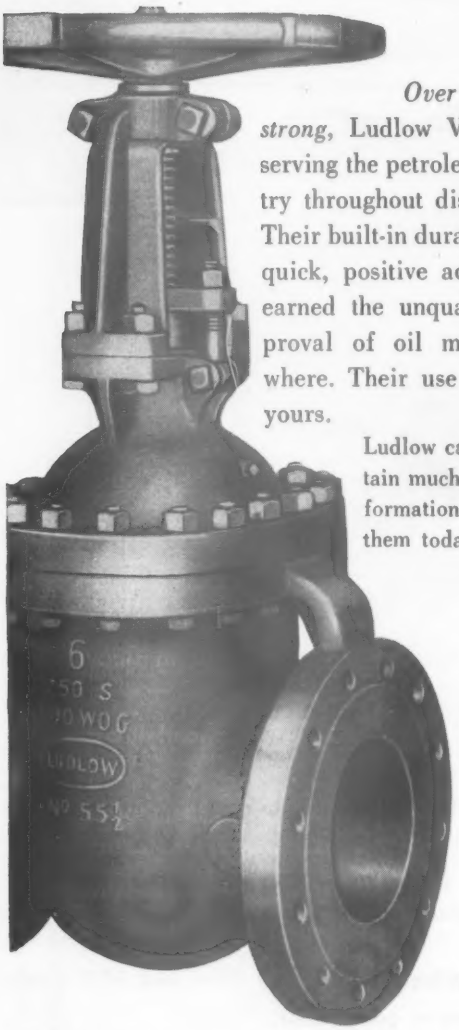

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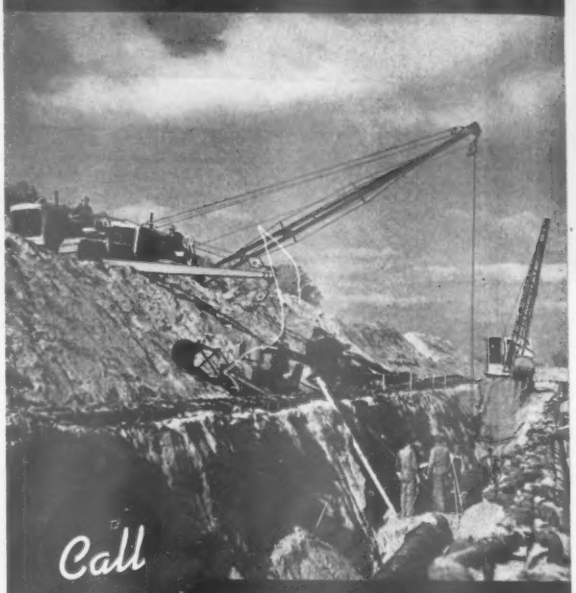

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Bell-hole welding with two operators running the stringer bead

Bell-Hole Welding Method Leads in Popularity in Recent Pipe-Line Jobs

AN analysis of recent jobs shows that the stovepipe, or bell-hole, method of welding has predominated with leading construction companies. This pipe-line welding technique gradually replaced the former roll welding type of pipe-line construction. Prior to the general adoption of "stovepiping", the roll welding methods were found to be too costly due to several factors. Additional machines and equipment such as tractors, dollies, skids and trucks were required, with added personnel to handle such material. Roll welding requires extra picking up of sections several joints in length with from two to four large tractors.

Use of Smaller Welders

Pipe-line contractors have been convinced that the best and most economical method of line construction is the stovepipe or bell-hole procedure. With this method, the smaller and lighter 200-amp. welders are used instead of the 400-amp. units required for the former method. Thus, the cost of transportation is cut approximately one-half and welding production, using ⅛-in., 5/32-in. and 3/16-in. electrodes for stovepipe welding, is faster than with the 400-amp. welder used for roll welding.

The stovepipe method is as follows: The pipe is lined up a joint at a time, and the two stringer bead welders run the stringer or first bead, making sure that 100 per cent penetration is obtained on the entire welded joint section. From four to eight welders run the fillet beads on the welded joint and also make the overlay or finish bead.

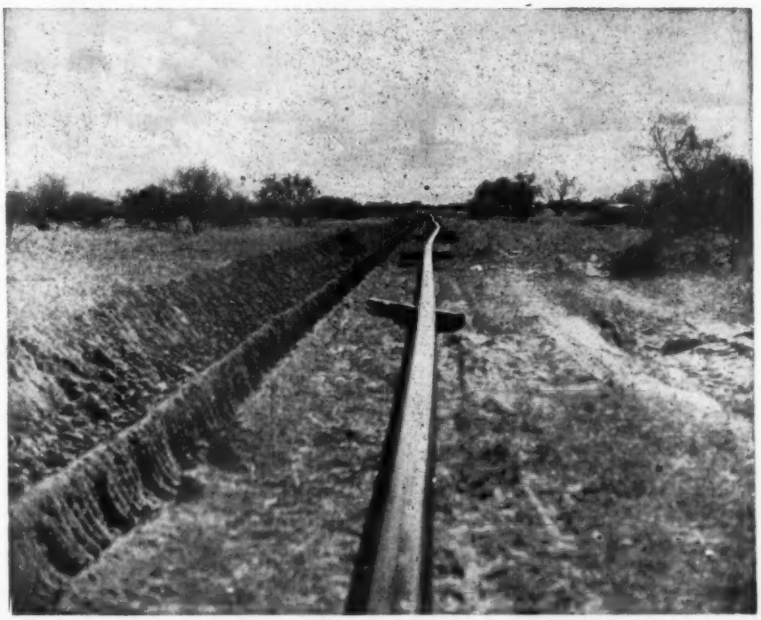
On a given size such as a 12-in line, the average good pipe line welder can run the finish beads on from 26 to 30 welds per 9-hour day. Many welders get more than that speed with everything running perfectly

Inside Line-Up Clamp

Another important advancement made in pipe-line construction came about through the introduction of a special inside-line-up clamp which is claimed to have increased line construction as much as 25 per cent. The clamp solves the problem of lining up large-diameter pipe having thinner wall sections.

The inside line-up clamp is hydraulically expanded to form a perfect circle against the inside walls of the pipe, thus affecting an absolutely smooth joint inside the pipe. With this device, there is no obstruction on the outside of the joint which further facilitates welding operations and eliminates the need of tack welding the pipe as formerly required.

The inside line-up clamp has recently been improved by eliminating the outside hydraulic pump, together with certain gages, tubing globe valves and check valves. Also the clamp can now be dismantled in a few minutes for transportation from one location to another.

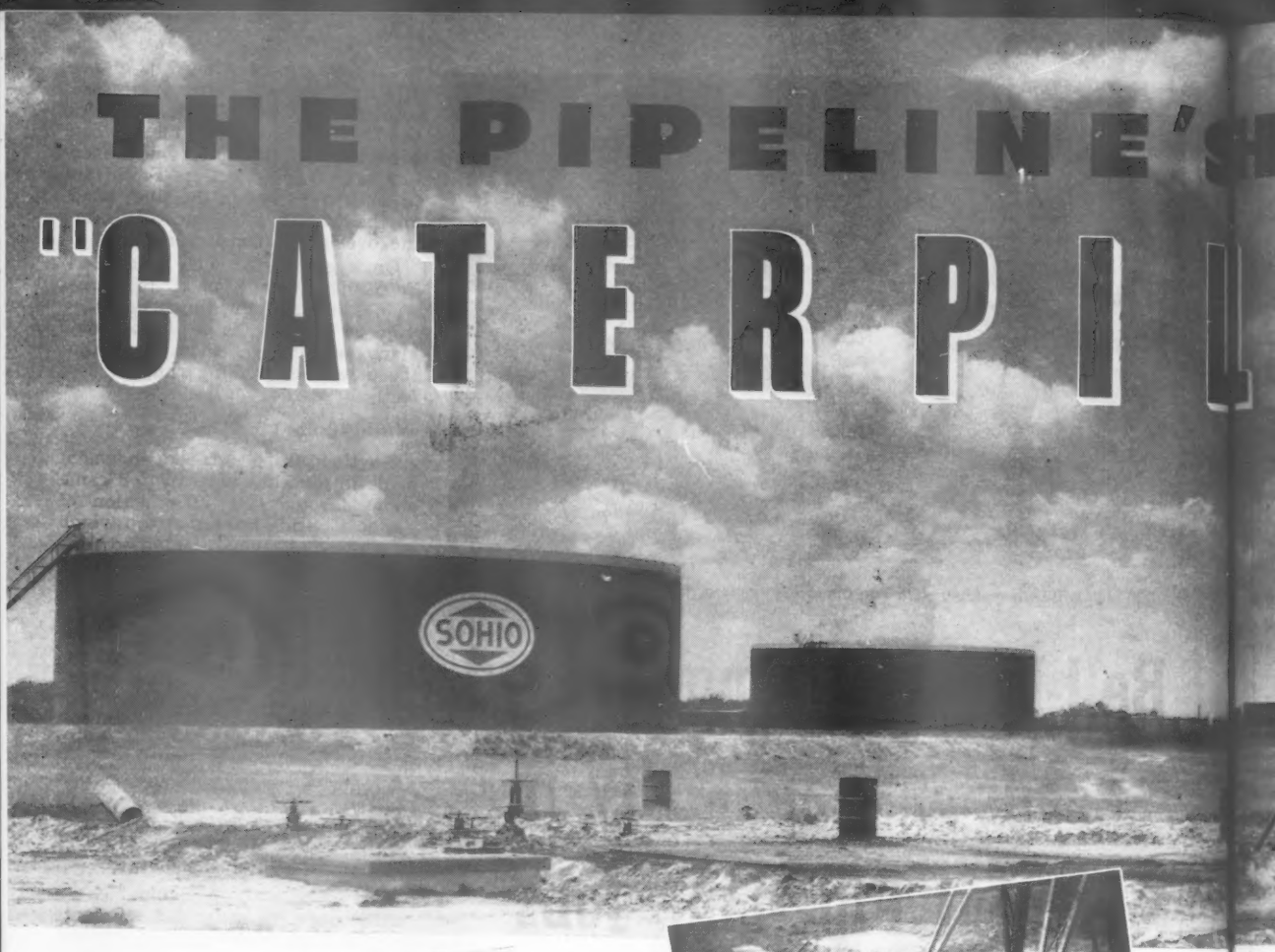


Welded 6-in. pipe on skids ready for lowering in

Note — Courtesy Lincoln Electric Co., Cleveland.

THE PIPELINE'S

"CATERPIL



Two "Caterpillar" Diesel D-13000 Engines powering Emsco drawworks and Gardner-Denver pump near Mt. Vernon, Ill.

In southern Illinois oilfields, these three "Caterpillar" D-13000 Diesel Engines furnish dependable power for a National rig.

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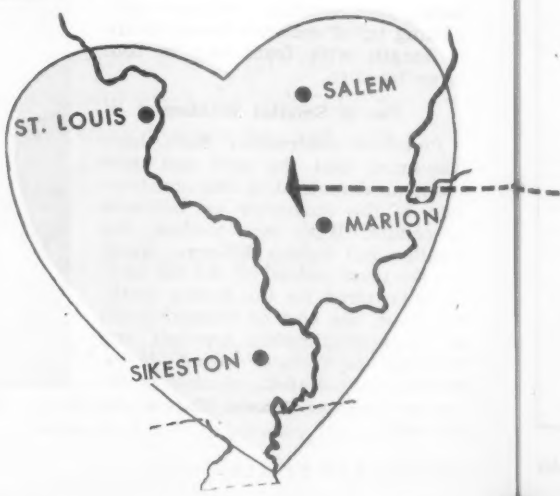

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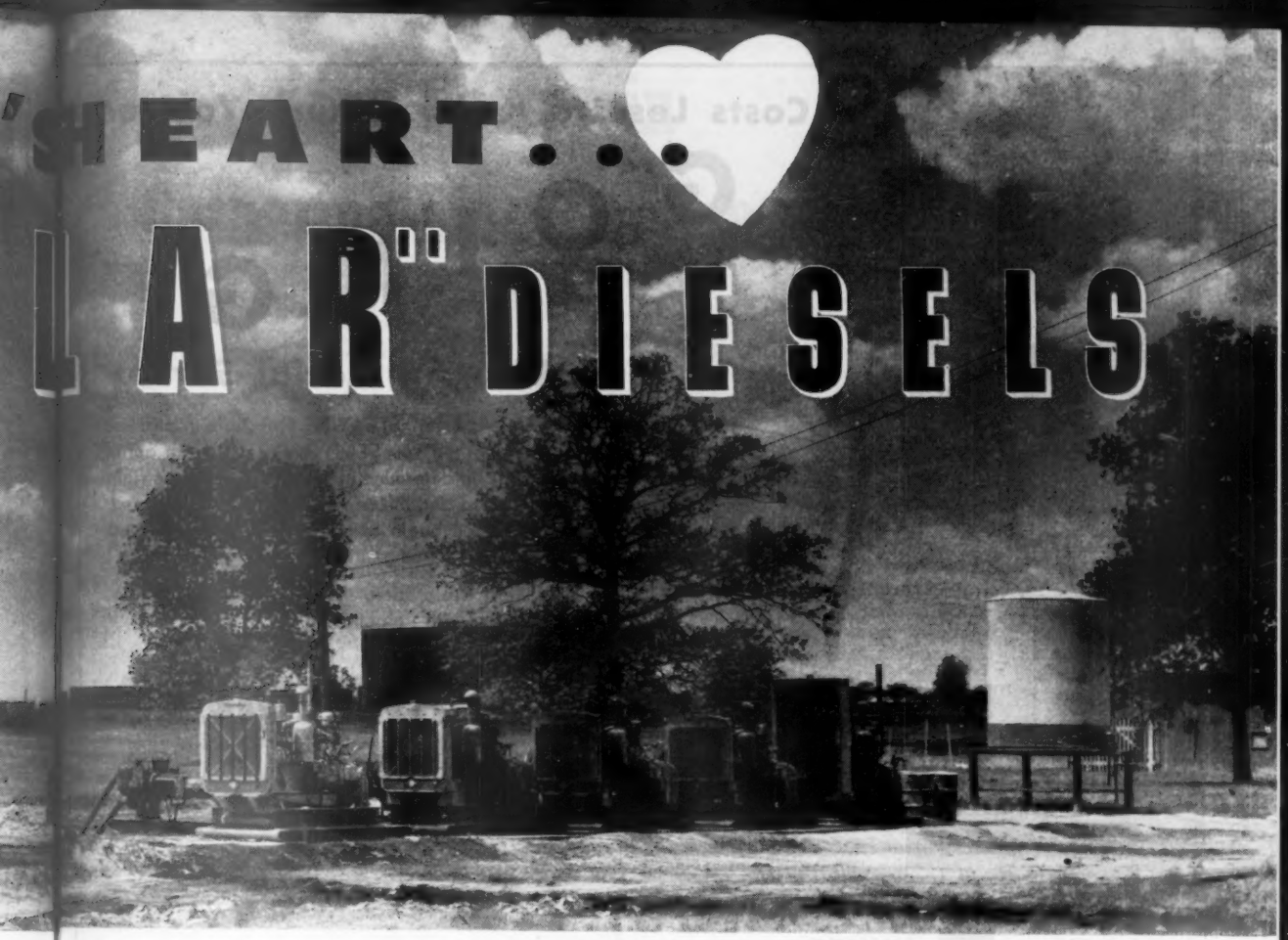

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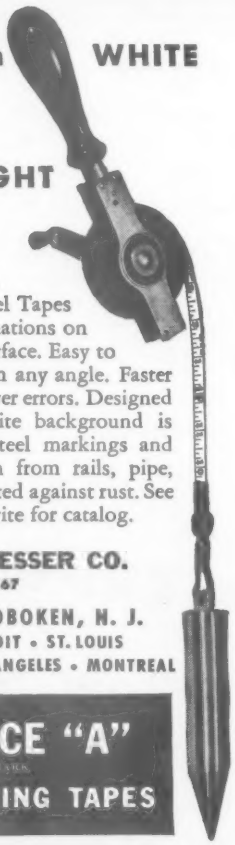

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Rotary Pumps in Gathering-Line Service

by J. F. Nickell

THE introduction of the modern oil-well pumping unit has been responsible for a series of changes in pipe-line gathering. A recent aspect of such operations has been the growing use of rotary pumps. With portable pulling units and clean-out machines available, the pumping unit has been designed for only pumping the well. Earlier pumping units were usually designed with a single pitman at the walking beam and could be fitted with a back-side crank, but the double pitman soon proved its worth and today a unit with a single pitman is extremely rare. The double pitman eliminated the bask-side crank, making it necessary to install a bell crank or a similar device in order to actuate a jerker pump. In most cases this is too expensive or is not feasible at all. The efficiency of this modern pumping unit together with its single purpose of pumping the well has resulted in a limitation of engine horsepower. The engine is selected for this one purpose and there is not enough reserve horsepower to meet the additional power requirements of a pipe-line pump.

The duplex reciprocating power pump, for many years standard pipe-line equipment for moving oil from flush leases and districts suitable for gravity systems, was used at first by most pipe-line companies to replace the jerker pump. It was smaller in size, usually with removable liners, of from 2½-in. to 4-in. bore and 6-in. stroke. It was powered by engines ranging from a single-cylinder model of 5 to 6 hp. to the more expensive multi-cylinder models of much greater power output. The initial cost of such a pumping unit complete with engine was several times that of the old jerker pump; it also required more attention and maintenance thus increasing operating costs.

While most companies have accepted the duplex reciprocating type as the only alternative for the jerker pump in gathering-line service, some companies have initiated the practice of installing rotary pumps. Rotary pumps had been used in various industries for years giving excellent service although the application was somewhat different from the requirements of a pipe line. Probably the greatest handicap the rotary pump had to overcome, in so far as pipe line application was concerned, was the common belief that it was a low-pressure pump which would not "buck" pipe-line pressures. The fallacy of this belief was more than proved in the years preceding the present war but the rotary pump did not gain the acceptance it deserved.

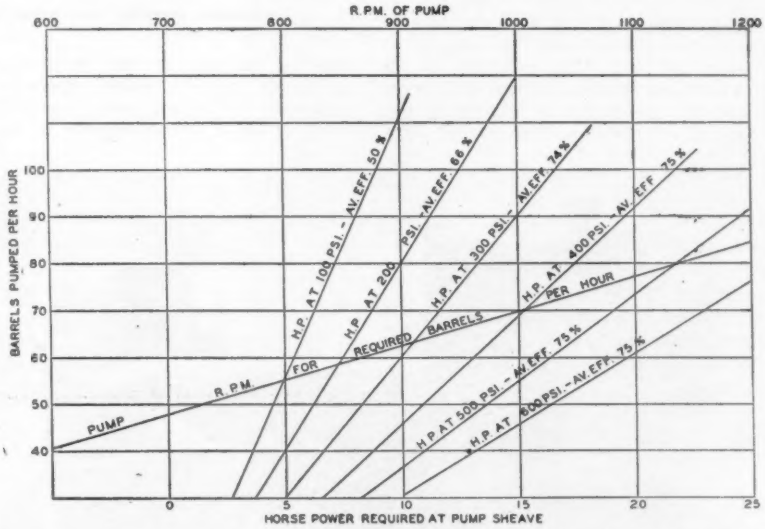
J. F. Nickell, pipe-line superintendent, Wilcox Oil Co., went from service in the Army in World War 1, during which he was in France, to engineering work with Atlas Powder Co. Shortly afterward he spent 8 years in engineering for Union Iron Works, Joplin, Mo. After a short period of engineering for a natural gasoline plant organization, he joined H. F. Wilcox Oil & Gas Co. to participate in the construction of the company's refinery at Bristow, Okla. Following this he was transferred to the engineering department in Tulsa where he served as construction supervisor until he became pipe line superintendent in 1941.

War perhaps stimulated greater use of rotary pumps for nearly the entire output of plants manufacturing reciprocating pumps was bought by the government for military services and war plants. Although the supply of rotary pumps was not plentiful, deliveries have been made within a reasonable lapse of time which, no doubt, was the primary reason many companies made their first purchase of this type of pump for pipe-line service.

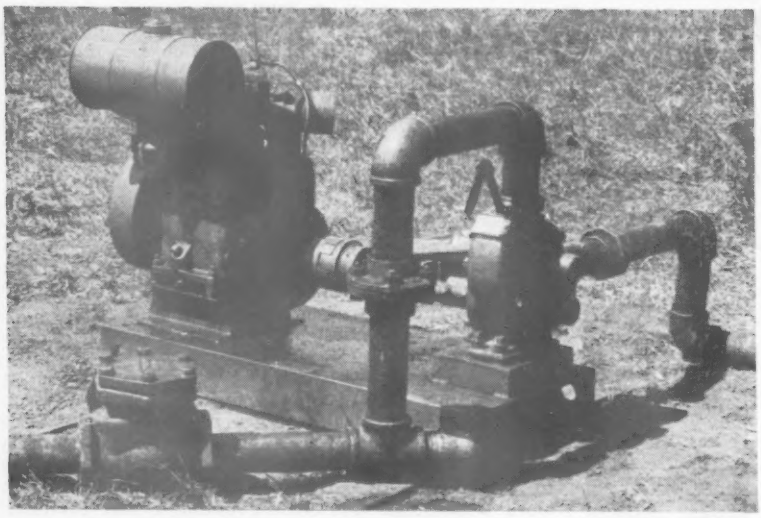
It would be a gross misstatement to make any claim that a rotary pump is a better pump than its reciprocating cousin, either in ability, reliability or efficiency. For a major job on pipe-line service the reciprocating pump is still preferred. However, for gathering service where initial cost must be considered the rotary pump has certain significant features. Rotary pumps have a definite place in pipe-line operations but more as alternatives for the old jerkers and not as replacements for reciprocating power pumps.

There are quite a variety of rotary pumps available, all using the rotary movement for the propelling mechanism but differing widely in design. Some use interlocking pumping gears or star wheels to force the fluid through the pump outlet or discharge; others might be described as using a concentric rotor in an eccentric case; still others use the screw or worm principle.

Although rotary pumps most fre-



Performance curves derived from data obtained in field operations, indicating speed of pump and horsepower required at pump sheave. Example: If 60 bbl. is required per hour, follow horizontal line to intersection with r.p.m. curve and from there follow vertical line to top of the chart which indicates 865 r.p.m. as the required speed. Follow horizontal line from 60 bbl. per hour to hp. curve (for estimated working pressure), for example 500 psi., thence down to the bottom of the chart where a required 16.4 hp. at the pump sheave is indicated



Rotary pump driven by a 3½-hp. engine on a lease near Stroud, Okla., which pumps 80 bbl. per hour of 45° A.P.I. gravity crude oil through approximately 1,000 ft. of 2-in. pipe to tanks at a relay station. The strainer is in the 3-in. and 3 x 2-in. swage nipple at the right. Pump pressure under load, 42 psi.

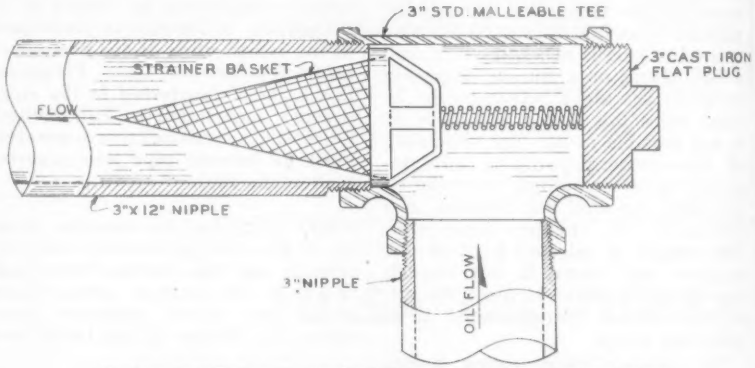
quently encountered in industry are built for low working pressures of 125 psi. or less, it is not at all uncommon to find them in high-pressure service up to 1,000 psi. or more. Many of these high pressure pumps are not designed to move a large volume and thus are not suitable for pipe-line service.

A field gathering pump in pipeline service is usually required to move from 20 to 100 bbl. of oil per hour against line pressures ranging from 50 to 600 psi. The rotary pumps now in pipe-line service function satisfactorily in this range. Most of them are of the interlocking-gear type, built in various sizes to suit the volume and working pressure required. The quantity of oil which one of these pumps will move can be governed by changing the speed of rotation, this being limited, of course, by the maximum r.p.m. or safe working pressure. However, it is not good economy to purchase a pump capable of delivering 50 bbl. per hour against 600 psi. if the line pressure never exceeds 300 psi. or if a delivery of 35 bbl. per hour is all that is required.

In using rotary pumps in pipe line service it is well to become acquainted with some of the peculiarities of their type. It is quite possible that the pump might be condemned as inefficient before it has had a chance to prove itself. If they are known, the pump can be installed and operated in such manner that it will give dependable and efficient service.

The rotary pump is more sensitive to oil starvation than the reciprocating pump due to the high speed of the rotor or pumping gears. In a rotary pump operating at 800 r.p.m. the outer edges of the pumping gears are traveling from 800 to 1,000 ft. per minute while the piston in a reciprocating pump of 10-in. stroke operating at 54 strokes per minute, travels only 90 ft. Although the pump shaft bearings usually are lubricated from the outside by means of Alemite or grease cups, the lubrication of the interlocking teeth on the pumping gears is dependent on the fluid in the pump chamber. If the pump chamber becomes void of fluid the resulting lack of lubrication on the gear teeth will cause the pump to run hot with the possibility, of course, of damaging the pump. For these reasons the rotary pump will give the best service with a flooded suction and with the suction line graded with a constant fall from the tanks to a point directly under the pump intake. If a short riser is used in connecting the suction line to the pump intake all possibility of gas lock is eliminated and a constant supply of oil to the pump is assured.

Although a flooded suction is desirable it is not necessary. The rotary pump, being a positive displacement pump, will pull approximately 20-in. of vacuum, if in good condition. However, since most crude oils contain some gas or light ends



Strainer installed with standard fittings to protect a rotary pump

Rotary pump driven by 30-hp. engine pumps 50 bbl. per hour against 400 psi. Maximum working capacity of the unit is 65 bbl. per hour against 600 psi.

Portable Centrifugal Oil Movers

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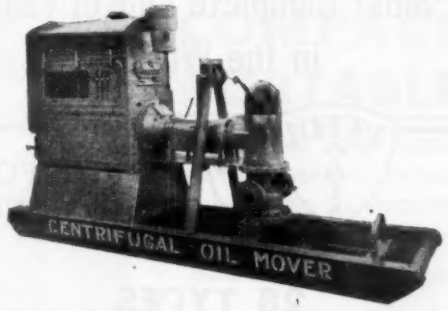
incorporating the advantages OF BOTH RECIPROCATING AND CENTRIFUGAL PUMPS

The Centrifugal Oil Mover is a development by the Power Machinery Company in response to suggestions made to us by various members of the oil pipe line industry for a portable engine driven pumping unit which has the desirable features of both reciprocating and centrifugal pumps. This is our solution to this demand.



4" Model VTR Centrifugal Oil Mover set up for pumping

4" Model VTR Centrifugal Oil Mover with pump folded into skid base for portability and shipment

APPLICATIONS

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3. Gravity Line Boosters.
4. Tank Farm Transfer Service.
5. Tank Pump-out Units.
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5. Capacity Range possible without change in Speed or Parts.
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4" Model VTR Centrifugal Oil Mover
(One Unit)

Engine RPM	CAPACITY G.P.M.	CAPACITY Bbls.-Hr.	CAPACITY Bbls.-24 Hrs.	*Differential Pressure Lbs.-Sq. In.
1200	150	215	5,150	210
1200	200	285	6,850	200
1200	235	336	8,060	190
1200	270	386	9,260	180
1200	300	428	10,060	170
1200	345	493	11,800	160
1200	380	543	13,000	150
1200	410	585	14,000	140
1200	435	622	14,900	130
1200	460	658	15,780	120
1200	490	700	16,800	110
1200	510	729	17,500	100
1200	535	764	18,000	90
1200	550	787	18,900	80
1200	565	808	19,400	70
1200	575	822	19,700	60
1200	585	836	20,000	50

*—Based on 37 API gravity crude oil (.84 Sp. Gr.)

For series operation multiply pressure shown by number of units in series; i.e., two units in series would pump 15,000 barrels per 24 hours against 300 lbs. per sq. in. gauge.

For parallel operation multiply capacity shown by number of units in parallel; i.e., two units in parallel would pump 28,000 barrels per 24 hours against 150 lbs. per sq. in. gauge.

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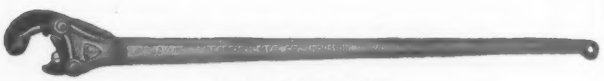
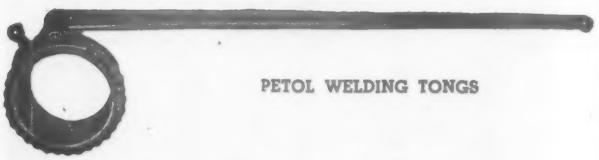


PETOL PIPE TONGS



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TITAN REVERSIBLE CHAIN TONGS

TITAN PIPE TONGS

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2. Unimpeded by valve discs or other interior obstructions, these straight-through-flow valves load tank cars at maximum pipeline capacity. No pressure losses—with EVERLASTING valves!

3. The self-lapping action of the valve disc on its seat, every time an EVERLASTING valve is opened or closed, maintains the drop-tight seal during a long life. This eliminates time lost for frequent maintenance. Thousands of these gasoline service valves have been loading tank cars for years without maintenance shut-down or trouble of any kind.

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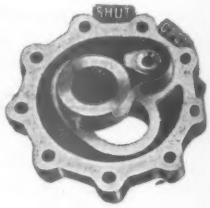


EVERLASTING VALVE CO., 49 Fisk St., Jersey City 5, N. J.

Everlasting Valves

for everlasting protection

which tend to gasify under vacuum, especially during the summer, the suction lines must be given careful consideration.

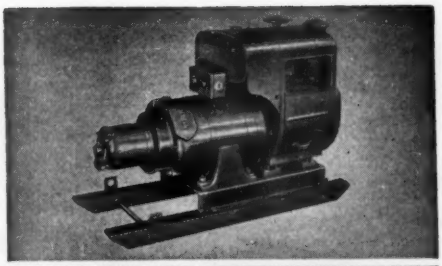
Suction lines of extreme length, insufficient diameter or improper grading should be avoided for the reason that they increase the suction effort of the pump with the accompanying tendency to form gas pockets in the line. This gas will eventually collect in the pump causing gas lock and a dry pump. Likewise the elevation of the pump, if too high as related to the tank connections, will have the same effect. Briefly stated, the hazard of gas lock and a dry pump will increase in direct proportion to the vacuum required to pull the oil to the pump.

Small Tolerance

If trash gets into a reciprocating pump it usually goes no further than the valves, destroying pumping efficiency until removed, but causing no damage to the pump. In a rotary pump the tolerance between the pumping gears and the pump case is, of necessity, very small. Trash entering the rotary pump, unless very small or very brittle, is a hazard that can cause considerable damage. It is advisable, therefore, to always install a strainer in the suction line as near as possible to the pump.

The discharge and suction on rotary pumps of the interlocking gear type can be reversed by merely changing the direction of rotation. It will pump while rotating in either direction with equal efficiency. If the clutch between the engine and sump is disengaged, a differential of a few pounds in pressure between the discharge and the suction will cause the pump to rotate allowing fluid to pass from the high pressure side to the low pressure side. If a pump has been in operation discharging against a tolerably high line pressure and the clutch is suddenly disengaged the pressure kick back from the discharge line will reverse the pump allowing pressure to pass through the pump and build up in the suction line. If the fittings on the suction line happen to be low pressure fittings and especially if they are cast iron, this would create a hazardous condition. To eliminate this hazard a positive check valve should be placed in the discharge line as close as possible to the pump.

When an area became so muddy that trucks could not negotiate it, in laying the India-China line pipe-line sleds were built from heavyweight pipe and Japanese steel plate. Huge tractors pulled the loaded sleds through the mud, and pipe liners laid the pipe as they went along.



Eleven basic sizes from 500 watts to 17,000 watts and 30 different types to meet all AC or DC power or lighting requirements. Housed or open models . . . available with wheelbarrow, buggy or trailer mounting. For operating a single tool or motor, or floodlight . . . or gangs of tools, groups of motors, or lighting entire areas. Easy to put in operation . . . economical to operate and maintain. Compact, portable, self-contained.

For complete details write for Bulletin 594.

MASTER GAS-ELECTRIC GENERATING PLANTS

COMPACT PORTABLE

SAVE TIME AND SPEED WORK WHEREVER POWER OR LIGHTING IS REQUIRED

THE NATIONAL SUPPLY COMPANY

Sole Distributor to the Oil Industry throughout the World

GENERAL SALES OFFICES—TOLEDO 1, OHIO

Branch Offices in or near all major oil fields in the United States, Canada, South America and other foreign countries

Manufactured by **MASTER VIBRATOR COMPANY,** *Dayton 1, Ohio*

This advertisement is neither an offer to sell nor a solicitation of an offer to buy any of these securities. The offering is made only by the Prospectus.

NEW ISSUE

$5,000,000

Ashland Oil & Refining Company

Twenty Year 3% Sinking Fund Debentures

Dated August 1, 1945 **Due August 1, 1965**

Price 100% and accrued interest

The Prospectus may be obtained from the undersigned

A. G. Becker & Co.

Incorporated

August 30, 1945

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A Specialized Service Designed by and for the Pipe Line Industry

A Better Method of Pipe Line Patrol

GLEASON ROMANS

1. More efficient because more area is patrolled.
2. Savings over other methods up to 75%.
3. Experienced pilots.
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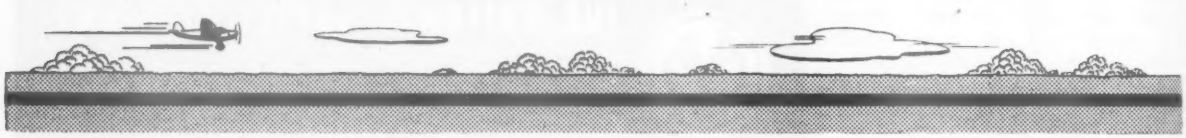
5. Leaks, breaks detected more quickly.
6. Approximately 4000 miles of line now under our patrol service.

GLEA FLYING SERVICE SON

References gladly furnished on request

AIRPLANE PIPELINE PATROL CO.

Commercial Airport, Tulsa, Okla.



RECIPROCATING PUMP UNITS

CENTRIFUGAL PUMP UNITS

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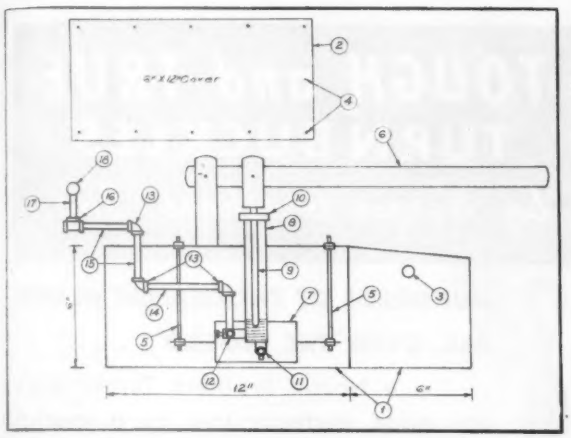
WISCONSIN AIR COOLED ENGINES

1 H.P. to 30 H.P.

Fabricated units for pumping oil, water, gasoline, and brine from low pressures to 1000 pounds pressure; units of centrifugal, rotary, and reciprocating types. Air compressor units and electric lighting plants. Standard and custom built jobs.

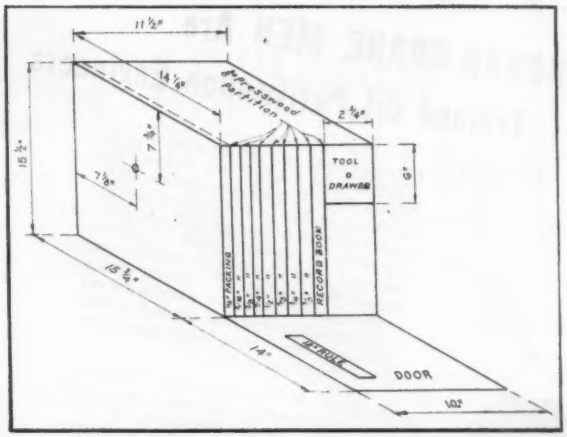
ROTARY PUMPING UNITS

ELECTRIC LIGHTING PLANTS



Pump specially developed for forcing a solvent through a plug valve to wash out old lubricant

Legend: (1) 10-gage steel. (2) ¼" steel. (3) ½" filler plug. (4) ⅞" x ¾" cap screw. (5) ½" x 6" pump anchor bolt. (6) ½" x 1" x 18" steel pump handle. (7) 2" x 4" pump body. (8) 1" x 6" pump barrel. (9) ⅞" x 6" pump plunger. (10) Packing gland. (11) Suction valve. (12) Discharge valve. (13) ¼" ell. (14) ¼" x 5" nipple. (15) ¼" x 3" nipple. (16) ¼" tee. (17) ¼" x 2" nipple. (18) ¼" metric valve.



Packing tools and material are stored in this cabinet devised to eliminate waste occurring as the result of careless binning and exposing opened packages to dirt and rust. On the inside of the top and bottom of the cabinet there are grooves ⅛ in. wide and ¼ in. deep for holding partitions. The door is hinged at the bottom of the cabinet. By means of a handle on top the cabinet may easily be carried

Measures for Improving Packing Practices

by James A. Martin

James A. Martin, supervisor of inspection and structure maintenance, Lone Star Gas Co., was born in Kansas and received his education in Denver. He went to work for Denver Gas & Electric Co. in 1908 and was transferred to Oakland Gas Light & Heat Co., Oakland, Calif., in 1910. Martin went with Lone Star Gas Co. in 1915 as pitot-tube operator. He served as assistant foreman in the Fort Worth district. In 1927 he was promoted from the chief dispatcher to his present position. He has given special attention to the prevention of leakage and the study of "unaccounted-for-gas" problems.

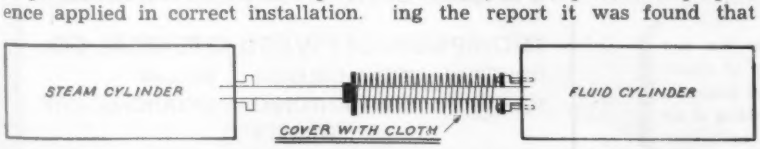
THOSE of us who have been long engaged in the transmission of gas or liquids through pipe lines sometimes expect only a series of jobs to be met and mastered as formerly. Actually the details of operation and maintenance of a pipe line should be classified in order to properly be studied. As a result of such a procedure it will be found that packing is of primary importance; this is evident by considering that valves, rods, flanges, etc., in a pipe-line system are at points of operation with high leakage potentials.

The term packing designates hundreds of items of many shapes and sizes, carefully engineered to meet exacting requirements imposed by varied circumstances of pressure, temperature, type of unit, and by the physical and chemical characteristics of the gas or liquid to be handled. Furthermore, packing is responsive to the skill and experience applied in correct installation. Too much stress cannot be put on wise selection of packing designed for the service to be performed and on the need for careful study of methods and practices of application in order to secure the highest degree of efficiency in operation and maintenance.

As a result of close attention given to packing problems by the management of the company in 1941, a survey of packing practices was made which served as the basis for an extensive report. It appeared that a pipe-line system might be operated with prevailing superior excellence and yet have evidence of improper rod packing, packing of valves with inefficient and sometimes injurious materials, packing of plug valves with insufficient lubricant or a lubricant not recommended, waste of packing material due to indifferent storing, careless cutting, and hit-or-miss requisitioning. Moreover, in the process of preparing the report it was found that there were many conflicting opinions regarding packing practice in general.

Investigating further through inquiry among representatives of packing revealed that this was not an unusual situation. In fact there was general agreement among them that a third of all the packing sold in the United States was never used because of waste and spoilage and that another third was improperly applied.

For the corrective program undertaken by the company early in 1941, a well-qualified employe was selected to concentrate on measures for improving packing methods through contacting packing suppliers, studying their specifications and recommendations, and investigating methods of other operating



Piston-rod cleaner for eliminating scoring

HONAN-CRANE MEN Are Trained Oil Purification Engineers

Honan-Crane oil purification equipment is sold ONLY by trained Oil Purification Engineers—skilled technicians capable of making an intelligent analysis of any problem involving dirty or contaminated oil. These men are also capable of supervising proper installation of Honan-Crane equipment to give you maximum oil purification protection against acids, sludges, abrasives or other damaging contamination.

Keeping oil clean pays big dividends in reduced maintenance and increased production in the operation of Turbines, Internal Combustion Engines, Hydraulics, Machine Tools, Compressors and other industrial equipment. Put this Honan-Crane Oil Purification Engineer to work on your problem—he will be one of the most important men in your plant. A Honan-Crane Engineer will call at your convenience. Write today.

HONAN-CRANE CORPORATION
Subsidiary of Houdaille-Hershey Corporation
206 Wabash Avenue
LEBANON, INDIANA

Honan-Crane has had many years of experience in the engineering and building of oil purification equipment.

TOUGH and TRUE TURNBUCKLES by Norris Brothers, Inc.

HUNDREDS OF THOUSANDS IN USE ALL OVER THE WORLD . . .

• Norris Brothers Turnbuckles are made perfectly true by a special straightening process. Ends are tapped in line, assuring true concentric pull. And as for toughness, we've turned them inside out and twisted them into a pigtail braid without a sign of fracture. Made in sizes and types to fit most needs. Ask your supplier, or write for circular.

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•BASIC HEADQUARTERS for OIL WELL Chemicals!

Valosa Phosphates
(All types)
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• *Inquire direct or through your dealer.*

THOMPSON-HAYWARD CHEMICAL CO.
HOUSTON NEW ORLEANS DALLAS
TULSA SAN ANTONIO OKLAHOMA CITY
WICHITA

firms in the industry. In addition to instructing company employes regarding correct packing practice, he was directed to devise and establish a comprehensive record system by which improvement could be readily noted and malpractice recognized. After 4 years of experience with the program the management is gratified by the general improvement observed.

Records must be of utmost simplicity. Numerous forms which proved inconvenient for plant operators have been eliminated and now requirements are met by only one form for upkeep by plant operators. Three forms are used by the packing specialist only, for gathering information on his preliminary survey in the course of which all units are classified with descriptive items. All entries are checked by visual inspection and conditions are noted regarding glands, rods, stems, yokes, packing, or lubricant. Dimensions are verified and unusual features are noted for later review.

Three Sets of Tables

Three sets of reference tables have been devised to aid in selecting packing. The first table gives length of cut required for from 1 to 10 rings and for box diameters ranging from ¼ in. to 5 in. The second table classifies packing generally showing types of material and services for which each item is recommended; this table also gives the crossreference class, the form of package, and the identifying number of the item in manufacturers' catalogs. The third table is devised to be used as a crossreference for the second table so as to assist in selecting packing for specific service.

From data gathered on the preliminary survey, packing selections are listed on the estimate sheet and quantitative requirements are determined for requisitioning needed materials from the purchasing agent. The packing specialist is notified when material reaches the plant so that he may participate in the actual repacking operations and that he may observe the first entries in the record book. Subsequently he makes periodic good-will visits and service calls, reviews records and takes notes on performance which may guide him in dealing with future recommendations. Surplus material at one location is listed so that it may be available for needs elsewhere on the system.

Much good was accomplished by inviting suggestions from plant employes. From cordial discussion of problems many effective methods, short cuts, and wrinkles were picked up which became available for adoption at other plants and dis-

No Idle Home Equipment When Repair Parts Come by AIR EXPRESS

Empty spaces on retailers' shelves or shortages of repair parts do not always mean that merchandise is not to be had. Often it's merely a matter of ordering a little at a time.

This is where Air Express steps in. It speeds merchandise to those shelves—even if in small amounts — so that customers do not have to be turned away or told that their household equipment cannot be repaired for weeks. It brings the spare parts stocks of the nation within but a few hours of retail stores. Very often, Air Express means next day delivery.

And not only does the speed of Air Express meet emergency needs in the retail trade, it puts suppliers' stocks so near at hand that it often means greatly reduced inventory and, therefore, faster rate of turnover.

Specify Air Express-a Good Business Buy

Shipments travel at a speed of three miles a minute between principal U. S. towns and cities, with cost including special pick-up and delivery. Same-day delivery between many airport towns and cities. Rapid air-rail service to 23,000 off-airline points in the U. S. Service direct by air to and from scores of foreign countries.

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Write Today for interesting "Map of Postwar Town" picturing advantages of Air Express to community, business and industry. Air Express Division, Railway Express Agency, 230 Park Avenue, New York 17. Or ask for it at any Airline or Express office.

Phone AIR EXPRESS DIVISION, RAILWAY EXPRESS AGENCY
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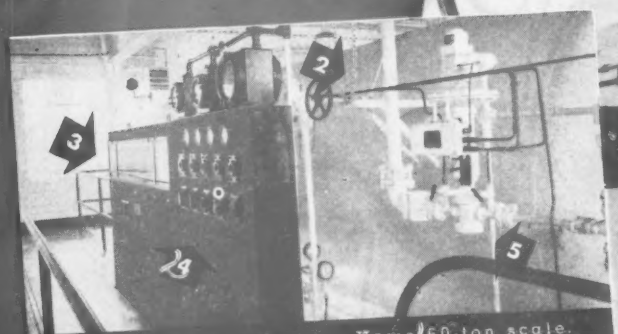
Setting the Pace . . .

SHELL OIL ADDS ETHYL FLUID AUTOMATICALLY AT ITS WOOD RIVER PIPELINE STATION

%PROPORTIONEERS% *Continuous* TREATING, BLENDING, DILUTING AND SAMPLING WILL WORK FOR YOU

1 – Ethyl Fluid is drawn under vacuum from 6,000 gal. tank car.



2 – Fluid storage tank on Howe 60-ton scale. 3 – %Proportioneers% Automatic and Flow-Responsive Loss-In-Weight Proportioning Scales. 4 – Complete alarm panel fully protects system. 5 – Specially designed Diaphragm Control Valve for Ethyl Fluid.

6 – Venturi Meter measures gasoline flow through pipeline and maintains uniform pre-set lead treatment.

A COMPLETE RANGE of minute adjustment is provided through single dial-type control.

%Proportioneers, Inc.% Loss-In-Weight Ethyl Blender proved an economical answer to a problem encountered by the Products Pipeline Department of this progressive oil company. This successful installation, developed cooperatively by Shell, Ethyl Corporation engineers, and %Proportioneers%, resulted from a careful survey of the economic and safety aspects involved. This is the first installation for the continuous blending of gasoline in pipeline operation . . . the only way that this operation has been satisfactorily performed.

CALL IN %PROPORTIONEERS% FOR ENGINEERING ADVICE AND EQUIPMENT

% PROPORTIONEERS, INC. %

WRITE TO % PROPORTIONEERS, INC.%, 37 CODDING ST., PROVIDENCE 1, RHODE ISLAND

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OILFIELD CORDAGE

Now that peace has been declared, we hope the day will soon arrive when you can again purchase FITLER Ropes of prewar quality.

FITLER Oilfield Cordage, backed by over a century of manufacturing experience, is recommended by satisfied users everywhere, to be the best for Oil Well and Gas Well Drilling.

THE EDWIN H. FITLER CO.
PHILADELPHIA, PA
Established 1804

IMMEDIATE DELIVERY
6" BLACK LIGHT WT.
STEEL
PIPE

Plain end for welding and grooved for Victaulic coupling.
★ 750,000 ft. 6" I.D.—6⅛" O.D.—⅛" Wall
Test 900 lb.—Pressure 650 lb.
Weight—approximately 8 lbs. per ft.
35c per ft., carload lots.
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GORDON IRON & SUPPLY CO.
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LOANS

ON INTERESTS IN
OIL AND GAS PROPERTIES

David Donoghue
Fort Worth Nat'l Bank Bldg.
Fort Worth 2, Texas

tricts on the system. Thus at some plants poor methods were supplanted by good ones developed at distant points. During regular visits specific problems were discussed with the packing specialist. Solutions might come from operators at another plant.

The following are a few of the "kinks" or operating ideas which have been disseminated through the packing specialist:

A wiper developed in an area of blowing sand proves unsatisfactory there but the principle of the device proves to be a cure for rod-scoring at a water pump 200 miles away.

A cabinet built in a West Texas plant for neat and handy storing of packing material and packing tools is widely copied and in some cases improved upon with a net result that waste occurring as a result of careless binning and exposure of opened packages to dirt and rust is practically eliminated.

Portable Packing Cabinet

A portable packing cabinet was developed by a packer in a northern district which has proved to be so efficient that it is now standard equipment throughout the system.

Too many plug valves have been sticking either from using a wrong lubricant, from lack of lubrication, from drying of the lubricant or from freezing. Anyway it must be "unstuck." A high-pressure hydraulic pump has been developed within the company organization which weighs only about 15 lb. and costs less than $30. This is capable of developing 2,000 to 3,000 lb. pressure in a dozen strokes; it is used for forcing a solvent through the valve to wash out the old lubricant. After new corrective lubrication is applied to the valve, it will operate freely.

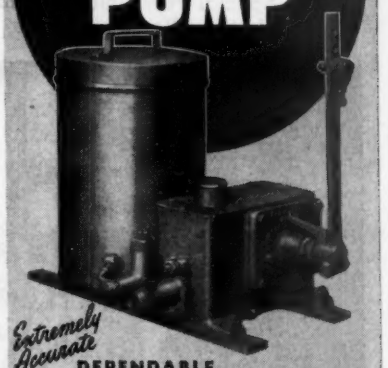
The packing specialist has prepared a 1,000-word discussion of proper methods for packing high-pressure valves for the guidance of the company safety supervisor, copies of which may be had on request.

To make available specific information to the management, a log book is kept for all plants and districts.

The packing specialist writes a report each week, giving in detail his current activities with notes regarding his observations, reports of tests, and various opinions of packers, often vigorously expressed.

By reporting operations in this way the management can keep in touch with progress chronologically and with reference to specific plants and districts.

McCORD
TYPE "C"
CHEMICAL MEASURING
PUMP



Extremely Accurate
DEPENDABLE

Accuracy of delivery in McCord chemical pumps is the result of a finely engineered design with a minimum number of parts. Dependability is insured because working parts are fully enclosed, protected from dirt and the elements. Specify McCord. For sale by National Supply Co.

Standard of the Oil Fields
McCORD
CORPORATION, DETROIT 11, MICH.

HARRISON
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Electronic
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Supplies
1422 SAN JACINTO PRESTON 4149
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GEOPHYSICAL
TRANSFORMERS

Sealed against sub-tropical humidity . . . "Sextuplex Shielding", improved uniformity, minimum size and weight, plug-in terminal block
Also available with terminal lugs

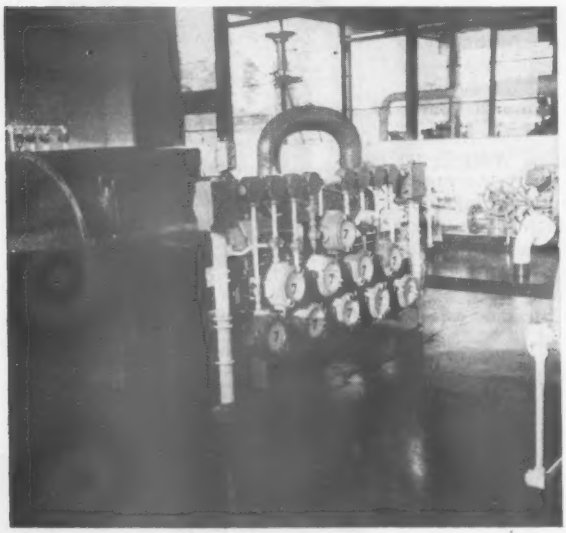
GEOPHONE CABLE
GOTT WATER CANS
BURGESS BATTERIES
CORNELL-DUBILIER CONDENSERS

Full Line of
GEOPHYSICAL ELECTRONIC
SUPPLIES

XUM

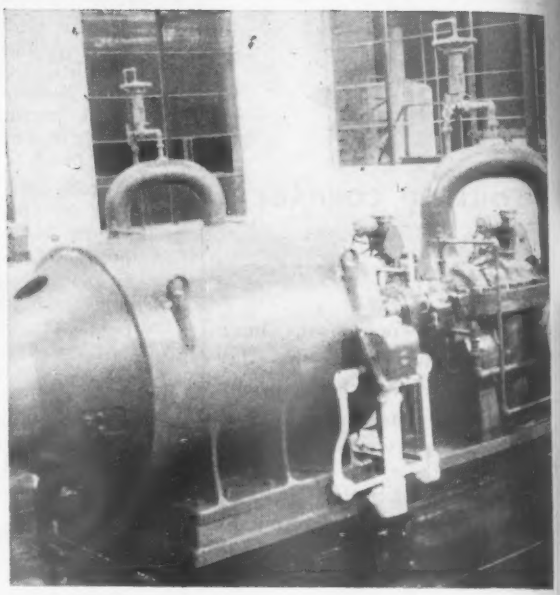
PRACTICAL SUGGESTIONS

Special Provisions at Pump Stations of the Plantation Pipe Line Co.



Protection for Remote Temperature Control

FOR temperature-limit controls on bearings of main-line motors and pumps, as well as glands and pump cases, Plantation is using vapor-pressure-actuated controls. These controls make an electrical contact to shut down the motor at predetermined maximum temperatures. It has been found that these control switches must be protected from the direct rays of the sun. This protection is provided by painting the glass face on the large explosion-proof housing enclosing the switch. A clear space in the shape of the figure "7" is left unpainted to allow the inspection and the setting of instruments without removing the glass cover.

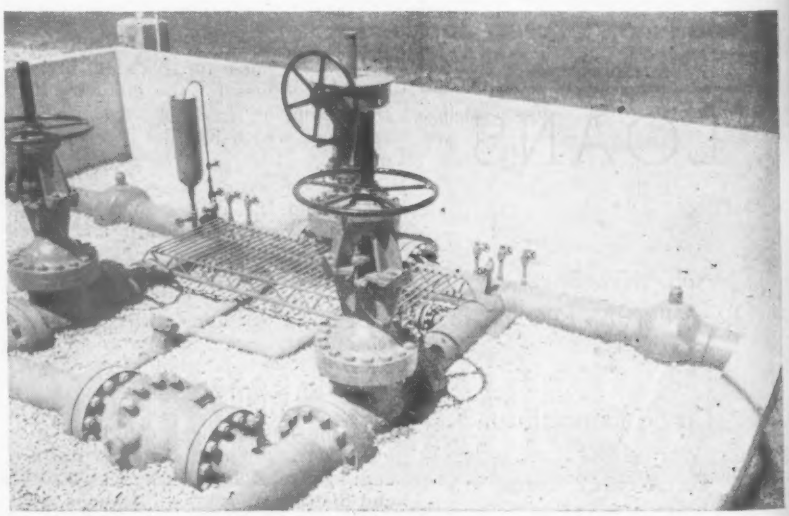


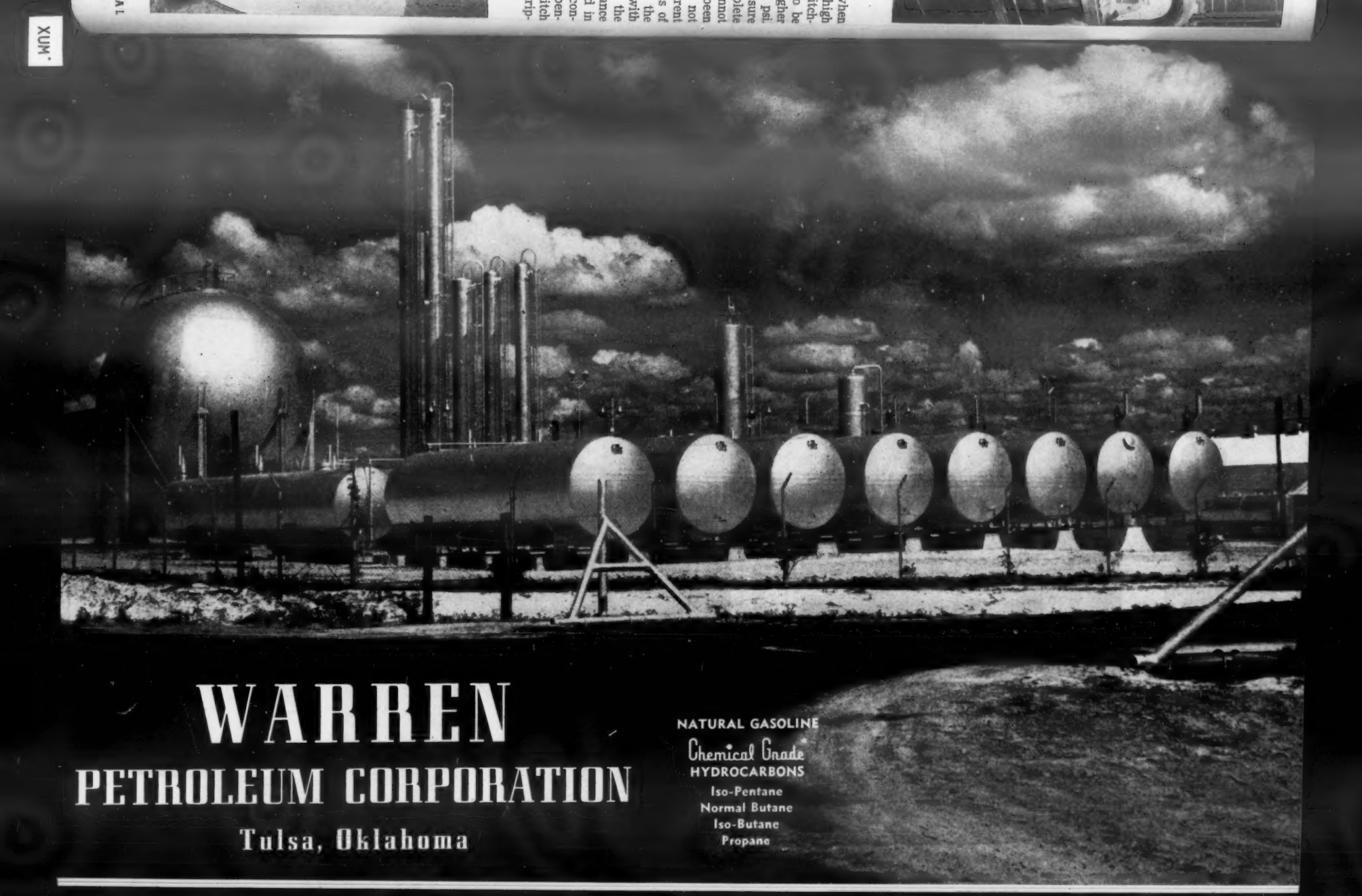
Protection for Switchgear

PRESSURE-LIMIT switches are set to stop a unit when suction pressure drops to 10 psi. or rises as high as 700 psi. Further protection is provided for the switchgear oil circuit breakers by not allowing a unit to be started unless the suction pressure is somewhat higher than the normal operating suction pressure of 50 psi. Main-line pump suction pressure closes a pressure switch when this pressure exceeds 75 psi., to complete the starting circuit. This means that the unit cannot be started until sufficient suction pressure has been built up on the unit and the oil circuit breaker will not open due to low suction while the high starting current of the motor is being used. This saves the contacts of the oil circuit breakers and increases the life of the contacts. Each main-line motor circuit is equipped with a set of hook-stick-operated disconnects so that the switchgear of a unit may be "killed" while maintenance work is in progress. These disconnects are enclosed in a small steel housing with a door opening in the control room. In order to prevent the inadvertent opening of these disconnects under load a small switch makes contact when the door is opened thereby tripping off the main-line motor.

Connecting Intermediate Stations to Line

A UNIFORM method was employed for connecting intermediate stations to the main line. Piping with valves was prefabricated so that it could be installed readily and accurately when a nipple was cut from the line. Pipe couplings were installed at joints and these couplings were covered with steel half wraps. To hold fluid coming from the line when it was cut, tank trucks were used for convenient and economical temporary storage. Cutting the line and installation of piping were completed in each case within a few hours.




WARREN
PETROLEUM CORPORATION
Tulsa, Oklahoma
NATURAL GASOLINE
Chemical Grade
HYDROCARBONS
Iso-Pentane
Normal Butane
Iso-Butane
Propane

These high pressures *take*

Cross-section of mercury chamber, METRIC orifice meter (of 50-inch differential range); one of the construction features important in the accuracy and dependability of this instrument.

Note the large area of the float at the end of the very long float lever, which insures accuracy and sensitiveness in the pen movement on the meter's chart.

This is but one of the many features of design described in detail in Catalog EG-2, which we shall be glad to mail you on request.

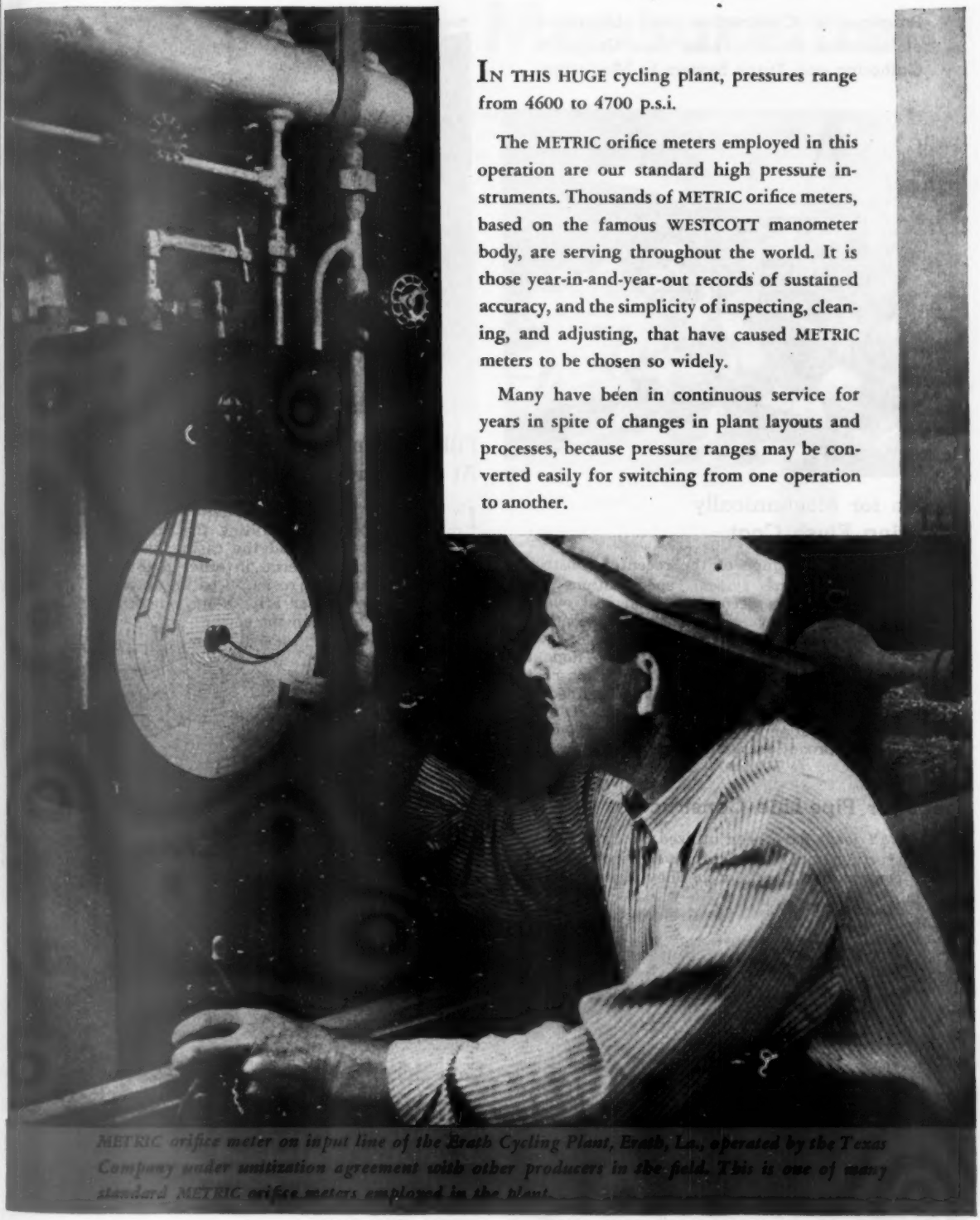
Outside adjustable pulsation dampeners in the bottom of the U tube connection are available.

AMERICAN METER COMPANY

INCORPORATED (ESTABLISHED 1836)

Albany • Baltimore • Birmingham • Boston • Chicago
Dallas • Erie • Houston • Kansas City • Los Angeles • New York • Philadelphia • Pittsburgh • San Francisco • Tulsa

the measure of a meter



IN THIS HUGE cycling plant, pressures range from 4600 to 4700 p.s.i.

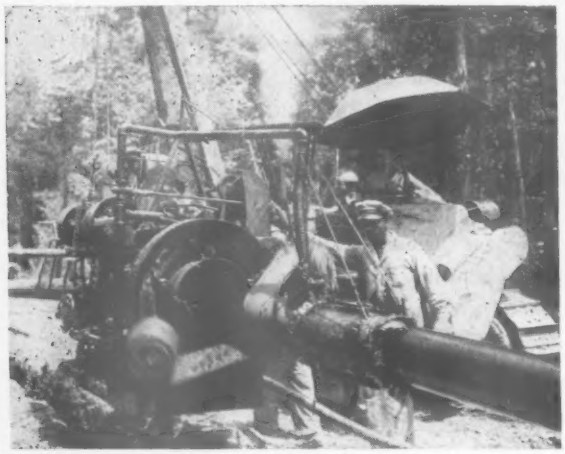
The METRIC orifice meters employed in this operation are our standard high pressure instruments. Thousands of METRIC orifice meters, based on the famous WESTCOTT manometer body, are serving throughout the world. It is those year-in-and-year-out records of sustained accuracy, and the simplicity of inspecting, cleaning, and adjusting, that have caused METRIC meters to be chosen so widely.

Many have been in continuous service for years in spite of changes in plant layouts and processes, because pressure ranges may be converted easily for switching from one operation to another.

METRIC orifice meter on input line of the Erath Cycling Plant, Erath, La., operated by the Texas Company under unitization agreement with other producers in the field. This is one of many standard METRIC orifice meters employed in the plant.

PRACTICAL SUGGESTIONS

Practices in Construction and Operation of Interstate Oil Pipe Line Co.'s Crude-Oil Gathering and Trunk System in Mississippi



Device for Mechanically Applying Flush Coat

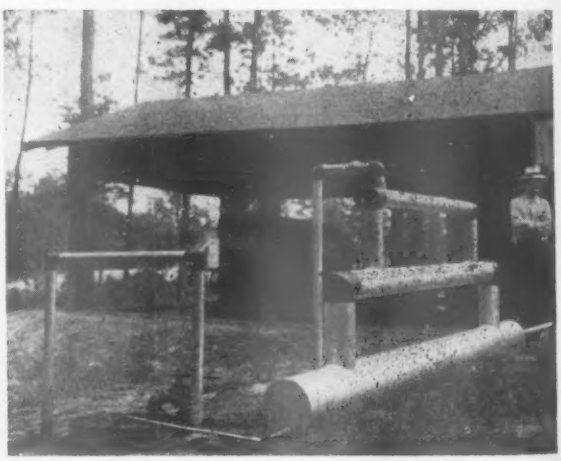
FOR protecting the pipe of the recently constructed Mississippi-Louisiana system, specifications called for the application of a second or flush coat over the spiral asbestos felt which wrapped the first coating on the pipe. The contractor, Associated Contractors and Engineers, added special equipment to the dope machine consisting of piping for conducting hot coating material to a point just above the pipe immediately behind the wrapping operations. By means of a pliable fabric sleeve attached to the piping, the coating material was spread over the surface of the asbestos felt.

Jeeps for Pipe-Line Construction

EX-ARMY jeeps have been utilized by contractors for transporting superintendents over pipe-line routes during construction operations. They have proved to be particularly useful for traversing ground too rough and muddy for standard cars. Four-wheel drive provides the kind of traction needed in difficult situations. When a jeep is bogged down, it is light enough to be lifted by hand in many cases so that it may be started again on ground that is more favorable. The jeep has not demonstrated any particular advantage over standard automobiles on highways.

Filling Annular Space At Highway Crossings

IN recent pipe-line construction more companies are making a practice of filling the annular space, between the pipe line and the casing at road crossings, with hot coating material in order to insure adequate protection against corrosion. Coating is poured from a kettle through a riser after vents and sealing flanges have been installed on the casing.



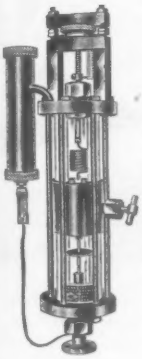
Gas Scrubber for Gathering Station

NATURAL gas used as fuel for a pumping unit on the gathering system in Mississippi is run through a type of scrubber which has given satisfactory service in the area. Ample settling space is provided in three horizontal nipples of three different diameters, the smallest being at the top. Drainings pass to a sump through small piping.

PIPE LINE Specialties

for

Testing and Measurement



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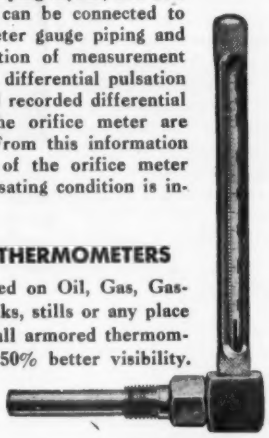

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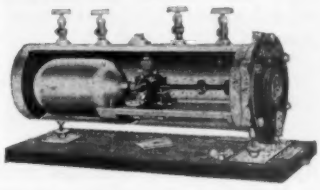

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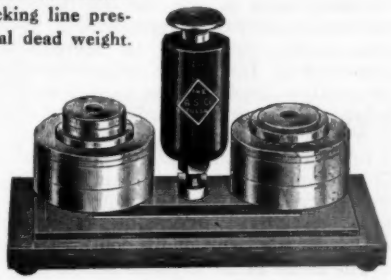

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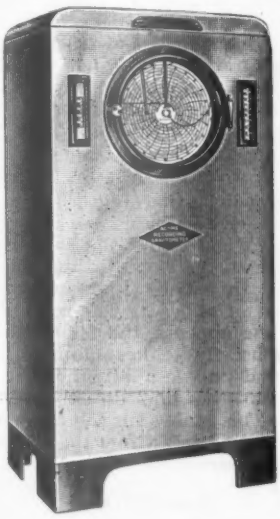

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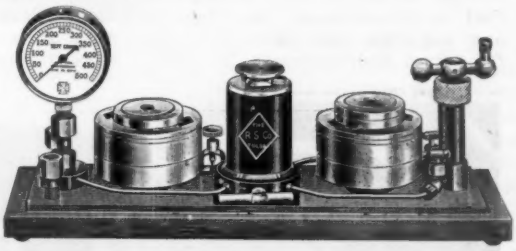

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XUM

High Efficiency Attained in Patrolling Lines With Planes

by Paul Reed

THE growing extent of airplane patrolling of pipe lines in recent months warrants recognition of this innovation as a distinctive 1945 feature. The number of major companies resorting to patrolling from the air has more than doubled in this period. Shell Pipe Line Corp. and Shell Oil Co., Inc., pioneered in this field by establishing the first program of this kind in 1939.

Since airplane patrolling is most effective on crude oil lines, this article will deal entirely with this type of service.

The records do not indicate that flying at the low altitudes required is hazardous for pilots engaged in carrying out their missions. Range of vision in an airplane is greater, thereby decreasing the possibility of missing leaks where the oil flows through a crevice before coming to the surface. From the air there is opportunity for better observation of multiple lines in grass, corn fields, wheat fields, or other places where a walker can accurately cover only a few feet on either side of his path. Over rivers and lakes the aerial observer can easily see minute leaks that are almost impossible to detect from the bank or by boat.

The cabin of an airplane serves as an office which facilitates the writing of notes to be dropped to pump stations, adequate maps on which to make notes, a log to jot down conditions of a swinging line or exposed lines for future reference, for making notes of any construction that might endanger the lines, or any condition that bears watching for future developments. The pilot is comfortable in winter, summer, or in rainy weather. He has a heater for winter, vents for summer, and the airplane cabins are as waterproof as most cars, so no discomforts need keep him from his work.

After turning in a written report, the pilot finds it desirable to discuss his findings with the dispatcher and in some cases with engineers at the stations over the company telephone lines. The engineers at each station should be notified in advance of the airplane's arrival over his station, in order to watch for messages that might be dropped. Pilot and dispatcher should have means for communicating readily with each other.

Types of Planes

No airplane now in common use is regarded as ideally suited for this type of work. Perhaps as aviation patrol develops some firm may build an airplane specially constructed with proper speed, good maneuverability, perfect visibility, long range, tandem seating and dependability. This dependability, of course, is of the utmost importance since the pipe-line patrol pilot has no chance to select a landing field more than a few hundred feet away. Fortunately modern airplanes meet the qualifications of dependability very well, but there are generally obstructions to the pilot's vision which keep them from being perfect patrol planes. Maneuverability is obtainable, but many highly maneuverable light planes are not desirable as they are too slow and do not carry enough load. The question probably arises as to how a plane could be too slow, when the chief aim is close scrutiny of the line. When flying a slow plane against a strong headwind, there may be difficulties when desirable airports are far apart. Fueling facilities adjacent to the right-of-way are quite a problem and frequently the airplane must have a 5 or 6-hour range to reach airports.

The airplane should have tandem seating to afford visibility for a superintendent, foreman, or company official who might wish to go along the line. In a side-by-side seat, only the pilot can observe the line.

Very little marking of the line is necessary, if suitable maps are available. If he knows he is within a quarter to half mile of the line, the pilot can usually find enough evidence to follow it. The more dimly the line appears, the higher the pilot must fly to keep himself lined up and the less attention he can give to the line directly beneath him. This makes his job more difficult and detracts from the efficiency of his observation.

Line Markers

A satisfactory and economical method being used to mark lines that are difficult to follow is to paint the top part of two or three fence posts white, where fences cross the right-of-way. If a telegraph wire follows the line, then there is no difficulty at all. Underbrush in the right-of-way presents considerable difficulty. Where it exists, little can be seen during the spring and summer months unless some clearing is

Cockpit of Airplane Pipe Line Patrol Co. plane showing strip map of right-of-way on reels and memorandum pad for recording observations, strapped to pilot's right leg

Patrol plane showing special panel of Plexoglass installed in the left side of the fuselage to facilitate observation of areas along pipe-line routes

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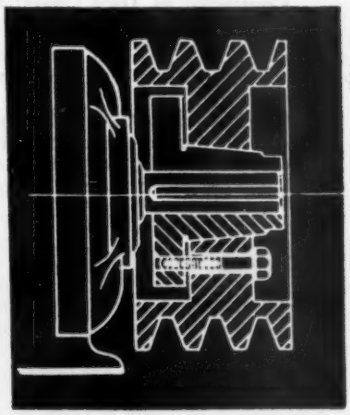

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done. However, such growth should be cut as a routine operation.

Regardless of all markings, it is most desirable that the same pilot fly the same lines on each trip, especially if the line is difficult to follow.

Contractor vs. Own Operation

Several aviation companies are specializing in pipe-line patrol. Plans are being made by several to install cameras and radio equipment.

A contractor in the airplane pipe-line patrol business has the advantage of combining the lines of several companies to form a complete round trip, thus having little or no idle flying in returning to his base, whereas a company operating its own patrol would have considerable deadhead in returning home. This elimination of return flying may be a factor in keeping the contract rate below a company's cost in using its own plane. Contracting of pipe-line patrol may become established in the future like other types of contract work for the industry because of the efficiency, specialization, and exploitation of new developments which a contractor's organization can achieve.

One of the features of airplane patrol that dispatchers and engineers value particularly is emergency patrol service. Patrol contractors are called upon frequently for runs to an area of shortage or pressure drop to discover whether a leak exists.

Among the pipe-line companies which have been patrolling pipe lines by airplane are: Ajax Pipe Line Corp., Empire Pipeline Co., Interstate Oil Pipe Line Co., Kaw Pipe Line Co., Mid-Continent Pipe Line Co., Mississippi River Fuel Corp., Phillips Petroleum Co., Shell Pipe Line Corp., Standish Pipe Line Co., Stanolind Pipe Line Co., and Texas Pipe Line Co.

Emergency Practices On Longest Line

In the building of the world's longest pipe line from India to China, necessity mothered so many inventions that nothing seemed impossible to the American pipe-line engineers. The pipe liner's ingenuity played an important role in the delivery by July 30 of this year of 120,139,132 gal. of petroleum products through the pipe-line system to combat troops in Burma, road builders, and convoys traveling over the Stilwell Road.

Trucks supplied by the Army for hauling pipe were of the ordinary, six-by-six cargo variety, not ideal for the job since the pipe's overhang at the rear put a severe strain on the vehicle. A GI with logging experience was convinced that he could build a semitrailer similar to the type used for hauling logs in the U. S. Pacific Northwest.

He welded two truck bodies together and mounted them in the back of a lengthened 2½-ton engineer trailer. The completed semitrailer revolutionized the method of hauling pipe in Burma and China. Where only 68 joints of pipe could be handled in one vehicle before, the trailer could haul 178 of them. In addition this equalization of the load distribution lengthened the life of the truck. Within a short time all of the pipe-line companies had equipped themselves with similar trailers.

Bending pipe in the jungle was another difficult task. Lightweight invasion pipe could be bent by hand, but this often crimped the joints. A GI took a hydraulic lift from a wrecked dump truck, fitted it to a curved metal shoe, mounted it on a trailer made from reinforced heavy pipe, and wound up with a mechanism which could safely bend the pipe to any desired angle. The device could be operated by one man, and was light enough to be hauled through the jungle manually in areas which trucks could not negotiate.

Construction Methods for Interstates' Mississippi-Louisiana Line

by Paul Reed

IN the building of Interstate Oil Pipe Line Co.'s system for transporting crude oil from Mississippi fields to Standard Oil Co. of New Jersey's Baton Rouge, La., refinery in recent months it has been possible to observe 1945 construction methods together with certain features which have developed from the company's experience as well as practices adopted by the contractor for expediting the work.

This system, which provides the first direct outlet from Mississippi to a major refinery, comprises approximately 121 miles of 8-in., 10-in., and 12-in. To be specific, 50 miles of 12¾-in. o.d. extending from Maryland tank farm, North Baton Rouge, La., to a station site 2 miles east of Liberty, Miss.; 38 miles of 8¾-in., Liberty station to Cranfield, Miss., field; 32 miles of 10¾-in., Liberty station to Mallalieu field near Brookhaven, Miss.

The main trunk line from Liberty station to Baton Rouge is designed for an ultimate capacity of between 50,000 and 60,000 bbl. per day. The production in the fields served by this system has not yet reached this quantity and therefore the pumping equipment required to handle the maximum capacity of the line is not being installed at this time. At Liberty station two 400-hp. units are planned now with provision made to add others as they are required.

The contractor, Sharman & Allen, reorganized this summer under the new name of Associated Contractors and Engineers, had the first gang laying pipe May 1. Two weeks later a second gang began working north from Baton Rouge. Oil was moving through the Mallalieu-Liberty-Baton Rouge section on August 3. The Cranfield-Liberty section was finished August 23.

Approximately 60 per cent of the routes of the system were across timbered country. There was a stretch of 20 miles through a national forest. Commercial timber 8 in. in diameter and larger was cut into merchantable lengths and sold for pulp wood. Much of the timbered country traversed by the line in Mississippi was considerably rougher than it appeared at highways in the area. Hills were not high but they were frequently as steep as

1—Pipe gang tractors and welders working close behind the ditching machine. 2—Pull-type backfill equipment with spotter driving the tractor and the backfiller operator manipulating the controls for the backfill bucket board. 3—Tractor aiding ditcher to climb steep slope. 4—Position welding with the stovepipe method on the line supported on skids over the ditch

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those in a mountainous country. The terrain at the Louisiana end was quite favorable.

Power-driven saws were used for cutting larger trees in the clearing of the right-of-way. These saws were operated by outboard-type gasoline-motor equipment with chain drive. Two power-saw units were used by one gang. So successful was this power equipment that one gang, which started off to cut trees by hand in the usual way, later adopted power saws for cutting the larger trees. Specifications called for the right-of-way to be cleared for a width of 30 ft.

Ditch for pipe had the following minimum dimensions: For 8-in. pipe, 18 in. wide and 27 in. deep; for 10-in. pipe, 20 in. wide and 29 in. deep; 12-in. pipe, 22 in. wide and 31 in. deep.

Two Bending Methods

Bending of the pipe was done by two methods. The 12-in. pipe was bent by mechanical bending rig equipment hauled along the right-of-way. The 8-in. and 10-in. pipe was bent by a type of pivoted shoe installed near the bottom of a tractor "A" frame.

Sag and side bends were laid to fit the trench evenly and over bends were 8-in. to 12-in. above the trench bottom.

The practice of the contractor was to weld by the electric shield arc process with the stovepipe procedure. Approximately eight welders were with each gang.

Welding specifications called for the following sizes of electrodes for position welds:

1. For 8-in. and 10-in. pipe, first bead 5/32 in., second bead 3/16 in. or ¼ in., third bead ¼ in.

2. For 12-in. pipe, first bead 5/32 in. or 3/16 in., second and third beads ¼ in.

Cleaning was done with a mechanical cleaning machine of the cutter type which was also equipped with brushes. Both brushes and cutters were used in all cleaning operations; these were carried on where inspectors considered them necessary.

The entire line is protected by a procedure which has been satisfactory in the experience of the Interstate company in previous operations. One coating of heavy petroleum pipe coating made by Standard Oil Co. of New Jersey was machine wrapped with spiral asbestos felt covered with another coating of petroleum pipe coating. No priming coat was used.

Coating material was maintained at temperatures between 180° and 200° F. in the portable kettles. The first coat, applied when the pipe was thoroughly dry, covered the pipe with a thickness of not less than ⅛ in. The second coating of not

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less than 1/16 in. over the wrapper was applied by means of specially devised equipment attached to the rear of the dope machine. Consequently one unit traveling on the line handled all three operations of applying two coats and one wrap.

Pipe was lowered into the ditch immediately after coating and wrapping. Slack loops were placed at points where the nature of the terrain made them desirable in the opinion of the inspector.

Backfilling was done by both bulldozer and pull-type backfill equipment having two operators — the spotter who drives the tractor and the backfiller operator who manipulates the controls for the backfill bucket board.

Where the line was laid across rivers and creeks the pipe was protected by coating but was not wrapped. At four stream crossings for the 12-in. line, river clamps were spaced at 40-ft. intervals and the pipe was placed in a trench under the stream bed with 12-in. covering. For two 8-in. line crossings, clamps were spaced 20 ft. and 25 ft. apart and the covering was 12-in. and 18-in. At two 10-in. crossings clamps were 20 ft. and 30 ft. apart and covering was 12-in.

Practices at Road Crossings

At highway and railroad crossings, casing vents, etc., were installed to meet specifications. Where required, the outside surface of casing was coated. The space between the pipe and the casing was filled with pipe coating material poured hot into the casing after pipe had been installed and the ends of the casing had been sealed.

Instead of previous methods for swabbing pipe, in sections, the contractor drove a swab through the line with compressed air. This method permitted swabbing the line in sections of various lengths from ½ mile to a maximum of 5 miles. The lengths of line swabbed were determined by the contractor.

After completing the line, it was tested for leaks by sections by means of compressed air maintained at 100 lb. pressure for 24 hours. A calodorant was introduced into sections of the line when it was filled with air.

A hydrostatic test was applied after the line had been filled with crude oil, which required raising the pressure to 800 lb., held for 24 hours. Following this test a standard scraper or plug was run through a tested section to finally ascertain that there were no obstructions.

A characteristic feature of 1945 pipe-line construction operations is the utilization of released army equipment. On this project, the contractor had one jeep, three reconnaissance cars and two 1½-ton trucks, all well adapted for traveling over rough and muddy ground of the pipe-line right-of-way.

Pipe Line Boat

When monsoon floods interfered with laying the India-Burma-China line, marooned construction men at the Tawang River built a boat out of salvaged materials capable of carrying 40 joints of pipe, 3½ tons of cargo, or 42 men. A good V-8 motor was stripped from a wrecked Bren-gun carrier, along with other salvable parts including some armor plate. A 10-ton aluminum pontoon was begged from a nearby pontoon company. The motor was mounted in the 10-tonner. A drive shaft and universal were cannabalized from a defunct 2½-ton six-by-six truck and run back through a piece of 4-in. invasion pipe to an improvised propeller cut from the armor plate. From the gun carrier came the steering wheel.

A bridge along the Stilwell Road was built by the pipe liners to span the Salween Gorge in China. It is a foot bridge 700 ft. long, built entirely of salvaged Japanese and Chinese equipment. The pipe was laid across this bridge and engineers still walk across its dizzy heights to service the line.

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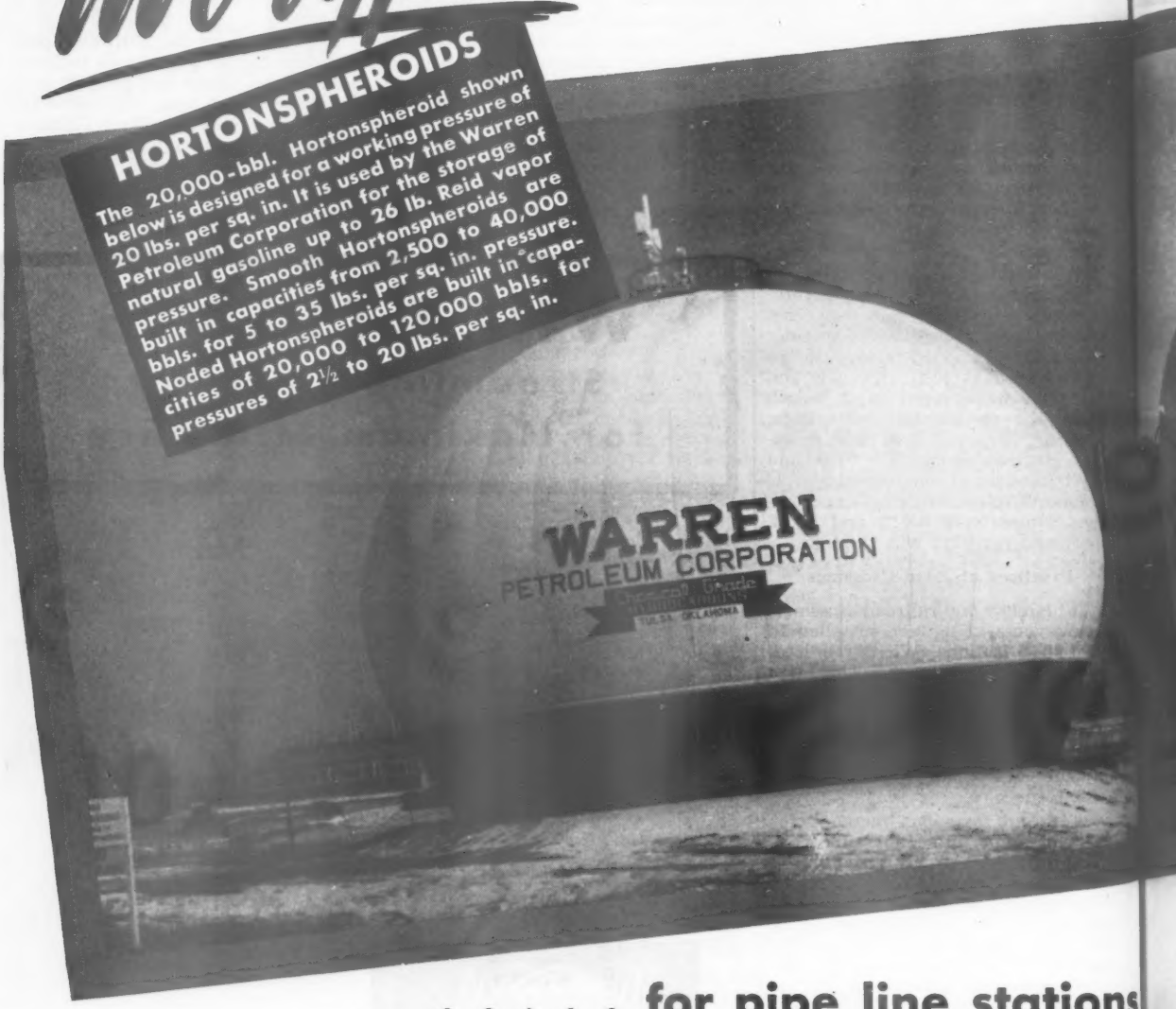

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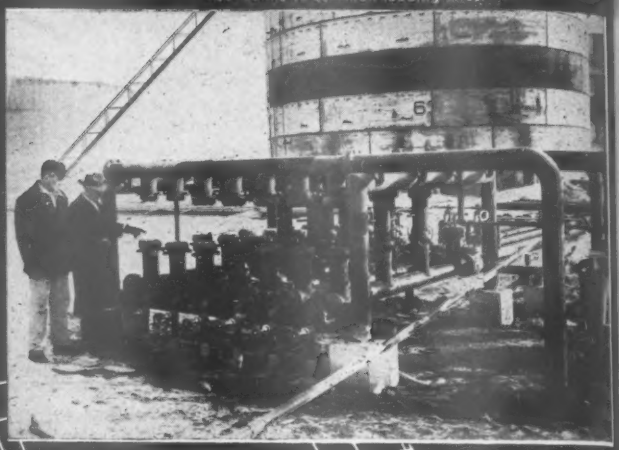

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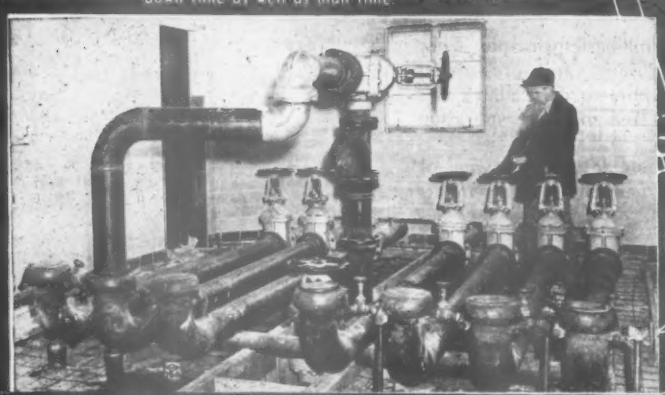

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MASON CITY, Iowa, the site of a recently completed truck-loading terminal of Great Lakes Pipe Line Co., is approximately midway between that company's Des Moines and Minneapolis terminal points. From time to time in the prewar years, consideration was given to construction of a terminal there.

One of the chief factors against the proposal was lack of pipe-line capacity out of Des Moines north. Also, during these years all products were loaded into tank cars, and northern Iowa and southern Minnesota points could be served either from Des Moines or Minneapolis as favored by tariff.

Transport truck loading, necessitated by the divergence of tank cars to long hauls, placed the Mason City terminal picture in an entirely different light. It became immediately apparent that at least several million truck miles per year could be saved by building a terminal at this point. Figures compiled to demonstrate rubber conservation were exceedingly impressive. Coupled with these definite economies from a standpoint of national resources was an increased throughput obtained by the use of an internal corrosion inhibitor, in the lines together with slightly higher operating pressures.

The site chosen for the terminal was a 20-acre plot approximately 7 miles west of Mason City and ¼ mile north of Iowa Highway 106, a concrete thoroughfare. A 20-ft. concrete roadway was built giving access to the highway, together with necessary accessory roads in the terminal site itself. Altogether, approximately 6,200 sq. yd. of concrete were poured as roadway slab. Rail facilities were secured from a short spur from the main line of the Mason City & Clear Lake Railroad, offering direct switching facilities at Mason City to main transcontinental lines.

The crisis in the sheet-steel situation was such that the purchase of new tanks was an impossibility, or a long deferred proposition at best. Fortunately, the company had seven line tanks at various pump stations no longer in service because of closed-system pumping being used. These tanks, all of the floating roof variety, were cut down and reassembled at Mason City as solid welded tanks. The addition of an extra ring resulted in three tanks, formerly of 30,000-bbl. capacity becoming 37,500 bbl. and four tanks, formerly of 17,500-bbl. capacity enlarged to 20,000 bbl. Certain refinements were added to the tanks which had not been previously installed. Blending spiders were standard equipment.

In order to facilitate the drawing of water from the bottoms, an improved type drain was designed. The tank bottom was first "surveyed" for the lowest point by playing a stream of water over the entire bottom surface. At the point where the water was deepest, a sump consisting of a 24-in. nipple of like length was sunk flush with the bottom surface. A 2-in. drain line was led from near the bottom of this sump up and out through the tank shell. A small purge line was arranged in a bypass fashion in order to displace all external lines of water, and thus prevent freezing in the winter months. The use of such obsolete and clumsy devices as frost

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boxes with their odious contents is thus avoided.

Free-Water Problem

Suction lines were equipped with a trough consisting of a half-section of 8-in. pipe approximately 10 ft. long elevated off the floor of the tank on supports. A metal hood was placed over these troughs to prevent the entrance of water while the roof drains were operative. These troughs nullify the usual eddying or vortex effect usually associated with swing lines or other suction fittings, and effectively prevent the removal of tank bottom water to the loading rack via the suction lines. The presence of free water in the loading lines is always an exceedingly aggravating problem at products-pipe-line loading racks, and practically any effort and expense may be justified which will successfully conquer this trouble.

The piping system of the terminal is somewhat different from the conventional design. Products are received from either of two main lines passing through the terminal site. The incoming manifold from the main lines is entirely electrical. When it is desired to receive a product, the operator presses a button. This closes the circuit which opens the valve into the terminal lines. As soon as this valve is fully open, the main line gate valve immediately downstream closes, thus bringing the entire stream into tankage. Each of the seven tanks is equipped with its separate fill line, and line to the loading rack. All lines are placed aboveground on fabricated supports. The usual field manifolds are entirely absent.

The fill lines to the tanks are brought into the cartwheel house and stubbed with a valve and a Unibolt blanking plug. Physical connection is made between the incoming main line and the respective tank line with fast acting Unibolt couplings. No reliance is placed on valves to prevent the admixing of various products. Their sole duty is to stop drainage back from the separate tanks. In like manner, there is no rack manifold. Each tank is placed in its respective product service through an arrangement of spool crossovers equipped with Unibolt couplings. If it is desired to change the product in a tank, its particular spool is removed and slid over to the proper rack line.

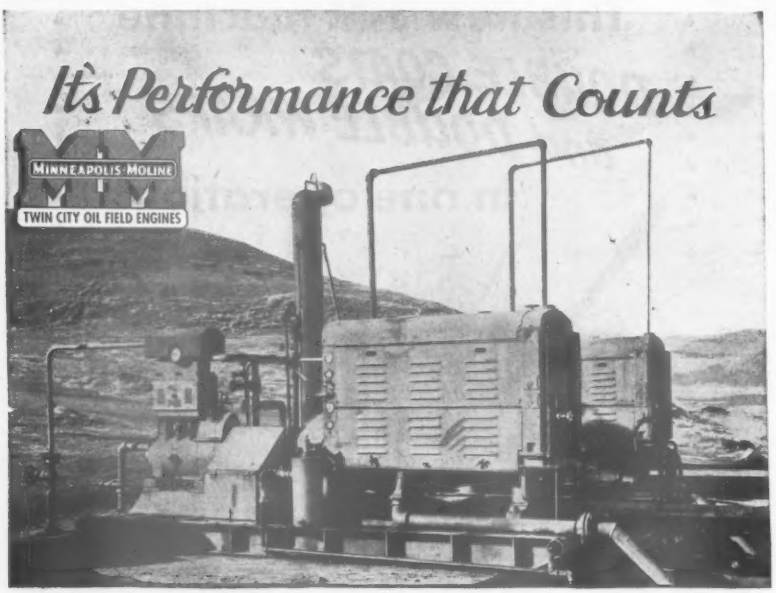
Expansion, Contraction Provisions

Since all lines are aboveground, it is essential that provision be made for expansion and contraction. Copper bellows type expansion joints are placed in all lines at regular intervals, together with guides and bumpers to keep the lines in their proper places.

In addition to the regular incoming and loading lines for each tank, there is also an incoming and loading line for Ethyl service only. These lines emanate at the Ethyl building, and are entirely separate from the pipes for handling other products. In this manner, any tank or tanks can be placed in Ethyl gasoline service on short notice. Provision is made for transferring product from one tank to another by means of an extra swing at the cart-wheel house.

Each tank is equipped with its own loading pump. These pumps are somewhat unusual in design as they employ a mechanical seal between the motor and pump and thus completely eliminate packing. The motor is filled with an oil of high dielectric strength which is buffered from the gasoline in the pump by a reservoir of a water-ethylene glycol mixture. Pressure is equalized at all points, thus preventing any dynamic upset in the balance level of the inert buffer. These pumps can operate indefinitely under water. Since all packing is eliminated, much maintenance is thereby avoided, as well as the nuisance of a recovery system for leakage. Each pump is equipped with a pushbutton for starting and stopping both at the rack and at the tank itself. A lighting arrangement is used to show the operator which pumps are running.

The main electrical service is brought into the terminal underground at 13,200 volts. This power



The *value received* from an oil field engine *is not measured* so much by its *cost* but rather by the *performance* that it gives—an engine that will operate 24 hours per day, day in and day out giving low cost, efficient performance free of mechanical breakdown is the one that *stands out* in the final analysis. *25,000 hours* of *continuous service* with stops only for oiling and greasing *is not uncommon* with *MM Oil Field Engines*. All the low cost, high performance features are *"built-in"* on *every* MM Oil Field Engine—that is why we say when *you* buy an Oil Field Engine *"It's Performance that Counts"*.

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is transformed to 440 volts for distribution through a single three-phase transformer. This transformer is of special design, incorporating breakers, cutouts and arrestors in the one unit. Power distribution to the 30-hp. loading pumps is by cable in conduits which are elevated on the pipe supports. Lower voltage transformers are provided for the pushbutton circuits and various services.

The Ethyl plant is the usual batch system, employing a weigh tank on continuous reading scales. The scales are equipped with a left-hand beam which enables the operator to manipulate controls without losing sight of the quantity being removed from the tank at any time. The Ethyl circulating pump is not the usual positive displacement type usually associated with such installations, but is a high speed (3,600 r.p.m.) centrifugal direct connected to its explosion-proof motor. All electrical wiring in the Ethyl building is in rigid conduit, with explosion-proof fittings being used throughout.

Loading-Rack Equipment

The loading rack is of sufficient size so that four transport trucks may be loaded at one time. Loading spouts are equipped with swing joints so they may be maneuvered into any position for loading the respective trucks regardless of the spacing of the domes on various capacity trucks to be served. Each spout is counterbalanced so it swings into a vertical position when released by the operator. All piping is underneath the rack walks.

Meters are used, with their attendant strainers and air eliminators. The counters and printers are elevated above the meter where the loader has ready access. Set stop mechanisms for automatically shutting off flow are standard equipment.

The rack lines are equipped with alleviators of a special liquid seal design to protect the piping from water hammer shocks caused by the sudden cessation of flow. The rack roof is fabricated from sheet transite.

Steam facilities provided by a small high-pressure boiler are available for thawing ice in transports, and also to provide heat in the rack doghouses for the benefit of the operator in winter weather.

Building Facilities

Building facilities at the terminal consist of a main office building with laboratory, Ethyl building, and such auxiliaries as a garage, boiler house, manifold house, etc. The main buildings are of buff-brick construction with a ceramic glazed tile interior and tile floors. The main office building has space for the billing clerks, terminal clerk, and the terminal superintendent's office. The heating of the building is by forced draft hot-air circulation from a gas-fired furnace in the basement. The heating registers are all mounted in the ceiling. The basement also contains storage space and a change room. The laboratory is completely equipped with a C.F.R. knock engine and all facilities for making physical tests on petroleum products.

The Ethyl building is of the same construction as the office building. Heating is accomplished with individual unit heaters. It may be remarked in passing that the natural-gas rate for heating is low enough to compete favorably with fuel oil, even if the latter is transported in the pipe line. Water facilities are obtained from a 4-in. extension of the main in Clear Lake, Iowa, a neighboring city.

The entire design of this terminal was predicated upon the obvious postwar mandate of complete and flexible facilities for the handling of a multiplicity of products as the occasion would demand.

There were numerous difficulties encountered during construction, chiefly due to weather, lack of materials, and labor shortage. Since much of the work was carried out during the winter, delays due to blizzards and heavy snows were the rule, rather than exceptions. Material shortages, particularly of an electrical nature, were especially serious. In spite of these factors, it was found possible to load the first truck with gasoline with the mercury at 12° below zero.

In general, the operation of the terminal has been as expected. It is believed that slight changes can be made in the loading rack design not only to facilitate loading of transports of ever-changing dimensions, but also to afford the rack employes better protection in severe weather. It appears that the enclosed rack, at least on the sides, will be inevitable for northern climates. Some skepticism was held concerning overhead lines—breaks caused by expansion—but these fears were groundless as no such difficulties have been encountered throughout a normal summer's operation. The final test of the terminal design must come with passing time, but every indication to date has been that the somewhat radical changes in plan over the conventional have been a definite improvement.

Atlantic Reverses Keystone System

Atlantic Refining Co. has reversed the flow in its Keystone Pipe Line, extending from Philadelphia to Pittsburgh, and is sending gasoline and other light products to meet civilian demands in its marketing area west of Harrisburg, Pa.

The Keystone Pipe Line was built to carry refined oil products westward from Atlantic's refinery. Atlantic made a rapid conversion early in 1942 so that the Keystone line could be used to transport crude oil east from Pittsburgh.

Similar speed was made with the end of the war in the Far East. Pumps were relocated at the refinery in Philadelphia and at the pumping station at Blue Mountain, west of Harrisburg, and all crude oil was cleaned from the line.

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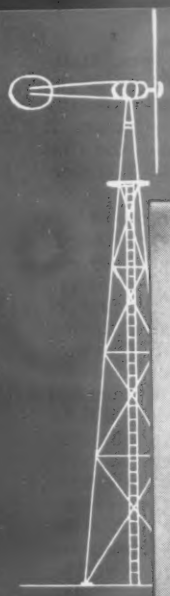

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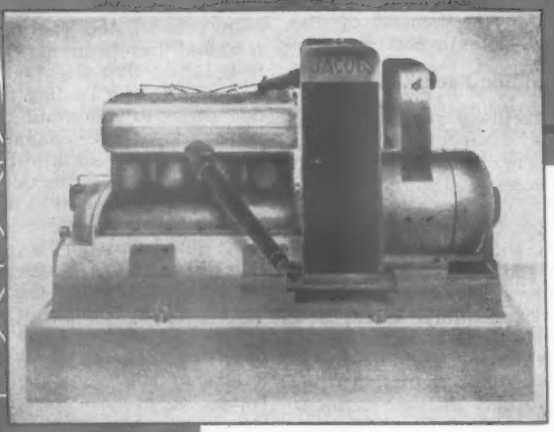

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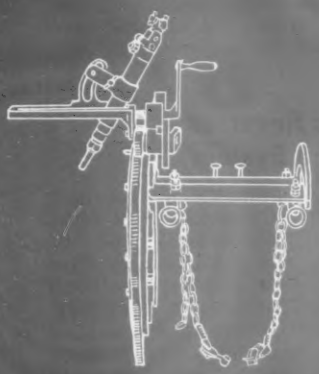

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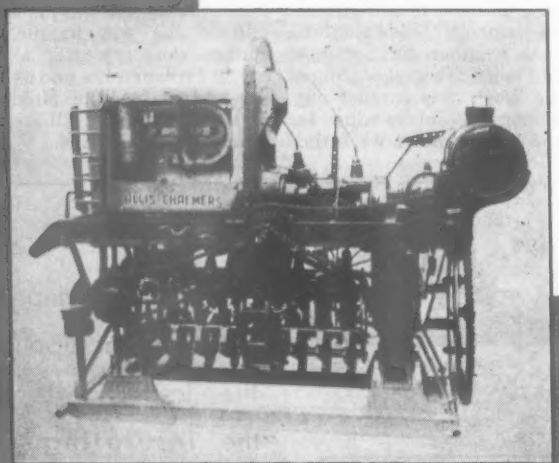

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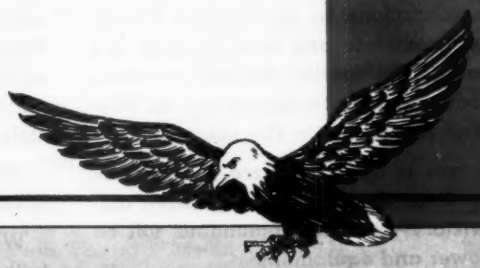

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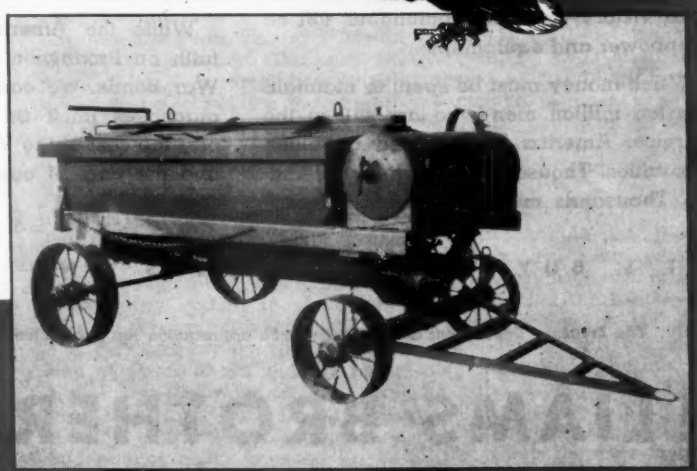

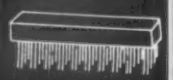

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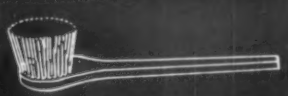

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We must provide for the widows and families of men who died for their country.

While the American Public has kept faith on Production Lines and in buying War Bonds, we cannot now relax. Bond purchases must be maintained now to pay the cost of the Victory; for occupation and the care of our Armed Forces overseas.

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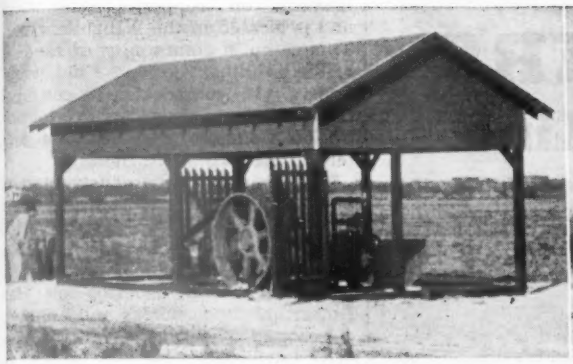
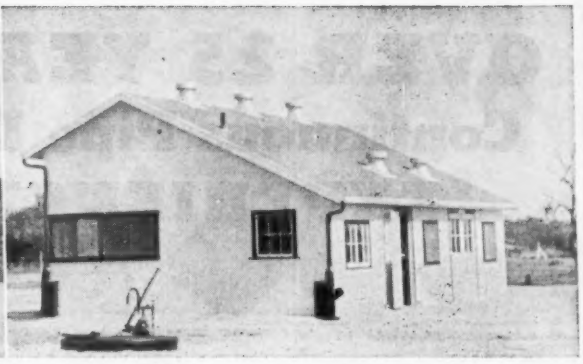


Field pumping unit in Willamar area



Main line pump station at Willamar

Wellhead to Loading Dock Pipe-Line System

by P. F. Williams

PAN AMERICAN PIPE LINE CO., with the construction of terminal facilities at Port Isabel, Tex., has rounded out a complete system for handling the production of the Willamar oil field from wellhead to tanker and, at the same time, its first year's operation of the Willamar to Port Isabell main line pipe line. This article will discuss briefly some of the details of construction and operation of the line.

Since the discovery of the Willamar field in Willacy County, Texas, by Pan American Production Co. in 1940, this producing area has become the major field in Southwest Texas. Due to inaccessibility of the field, the transportation facilities during the early part of the development made it necessary to deliver oil by truck to refinery centers. Early in 1943, new outlets were developed for the low-gasoline-content crude which, though limited in quantity, justified the use of tank cars, which were made available by Office of Defense Transportation. Development of the field was slow during the time of limited demand.

A more substantial market was established in 1943 when the high heater-oil and kerosene content made it desirable if delivered to the proper refineries in sufficient quantities. By 1944 the field had developed to a point where production and potential recovery justified the building of pipe-line facilities to supply this market, to lessen the cost of transportation and expedite the movement of these Willamar crudes.

Plans were immediately made for the construction of 34 miles of 8⅝-in. o.d. line to be laid from the field to the ship channel at Port Isabel, where tankers could be loaded for transfer to the refinery centers.

P. F. Williams, chief engineer, Pan American Pipe Line Co., is a native of Fort Worth, Tex., and received his education in Texas before spending several years in the 1920s in public works in Oklahoma. Later he was engaged in the operations of Gulf Oil Corp. in West Texas and Fort Worth. He was loaned by Gulf to War Emergency Pipelines, Inc., and participated in designing for the 24-in. crude oil line and the 20-in. products line at the Little Rock and Cincinnati offices. After the completion of this program, he joined the Pan American organization.

The first problem was to construct a gathering system to serve wells then on production and which could also be used in any future expansion of the field without the necessity for reconstruction of existing gathering lines. With this in mind, the field was divided into four parts, and control points selected in each of these four parts for the gathering pumps. A 7 by 10-in. reciprocating pump powered by gas-driven engines was installed in each location for delivery of oil to the main gathering tanks. Two 25,000-bbl. storage tanks were erected for field storage and the main-line pump station receives its oil from these tanks. When power becomes available from the new 26,000-volt electric transmission line now under construction in the vicinity of the field, these gas engines will be replaced with 50-hp. electric motors having automatic controls.

The design of the main-line pumping station was based on an ultimate 20,000-bbl.-per-day capacity, to be handled by four pumping units, each unit designed to be used for a variety of purposes, with the change of liner sizes.

The first installations called for one duplex double-acting power pump V-belt connected to an automatic-type engine, this unit furnishing at 60 s.p.m. 505 bbl. per hour, creating 270 lb. discharge pressure on the line. When production in the field exceeded the 505-bbl.-per-hour rate, a second pump was installed and smaller liners placed in each pump, this furnishing at 60 s.p.m. 675 bbl. per hour or 16,000 bbl. per day, creating a station discharge pressure of 450 lb. When this 675-bbl.-per-hour rate is exceeded, two additional 10-in.-stroke units will be installed. With a change in liner sizes, a total of 852 bbl. per hour or 20,400 bbl. a day can be handled without exceeding 700 lb. discharge pressure.

Manifold Construction

The manifold construction was of the simplest design, varying from the recognized standard designs only in that the heat exchanger for water cooling of the engines was installed on the discharge side of the manifold and buried underground. To secure good, clean water for cooling systems, a cistern of 1,000-gal. capacity was installed. The sump pump is fully automatic with an electrically operated turbine-type pump mounted on top of an enclosed steel sump tank.

The pump-station building, due to wartime restrictions, was constructed of transite materials with wood

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framing on concrete foundations and is located in the Willamar camp. This camp, a community of modern office buildings, cottages, and warehouses, was constructed in conjunction with Pan American Production Co. on a 30-acre tract near the center of the Willamar field.

The main line was constructed of 8⅝-in. o.d. Grade B seamless steel pipe with a wall thickness of 0.250 in. and a weight of 22.36 lb. per foot. A protective coating of hot asphalt was covered with asbestos felt. Pan American's own primer and enamels were used.

A telephone line, 45 miles in length, built for the exclusive purpose of operation, furnishes immediate communication at all times between the main-line pump station, the field pumping units, and terminal facilities at Port Isabel.

At the time the pipe line was placed in operation, the loading of tankers at Port Isabel was handled through leased storage tanks by contract with Coastal Refineries, Inc. In February 1945, War Production Board approved an allotment of material for the construction of terminal facilities at Port Isabel by Pan American Pipe Line Co. The terminal site is located approximately 3,000 ft. from the turning basin. On this site two new 96,000-bbl., all-welded steel - cone - roof storage tanks and a pump station have been constructed. The pump station building at the Port Isabel terminal is of brick construction with corrugated transite roof and tile floor.

The design of the pumping units for the loading of tankers was based on a capacity of 5,000 bbl. per hour, handled by two pumping units consisting of 6 by 8-in. centrifugal pumps V-belt connected to automotive-type gas engines with a 100-hp. rating at 900 r.p.m. A two-to-one drive between engines and pumps gives an operating speed of 1,800 r.p.m. on the pumps. A discharge pressure of 50 lb. is developed, with a 25-lb. pressure at the boat manifold.

Willamer-Port Isabel main line though, of course, not an extensive pipe-line system, performs adequately all the operations expected of a pipe line from gathering, to main line, to terminal, to tanker loading.

Ingenious GI's Span Gorge

In the Mogaung Valley of Burma it was found that a clearing for the pipe line could not be done with knives and machetes. Elephant grass 14 ft. high resisted the efforts until a truck driver dragged a large teakwood log behind the surveyors for the India-Burma-China line. The grass snapped off at the roots, and a few days later was dry and ready to be burned.

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Lt. Col. Joseph C. Britton, in charge of pipe line construction for the Army in the Far East for the past several years, has returned to assume active supervision of work handled by Eastern.

C. Hobson Dunn, outstanding in pipelining for over 20 years, has joined Britton as partner, bringing to Eastern a wealth of experience and ability.

Many big projects have been handled by Eastern since its organization in 1943, among them being the Big Inch Distribution System at Stanton Island; 150 miles of line in Colorado and Wyoming; 40 miles of take-up and reconditioning for Stanolind Pipe Line Co.; 50 miles of 22″ line for Phillips Petroleum, Borger, Texas; and a second big-inch job for United Engineering in New Mexico.

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Aerial Patrol of Lines Has Many Advantages

by Harry Nelson

AERIAL patrol of pipe lines is gradually becoming commonplace. Several pipe-line companies are now using the airplane in lieu of the conventional line walkers. Although a few companies have used this method for a number of years, most of the present aerial patrolling is of recent origin and on an experimental basis. As with aerial photography for pipe-line location, pipe liners are skeptical and have to be shown the advantages and economies. Pipe liners were reluctant to use aerial photography for almost a decade, but now nearly every pipe line of any size is located by means of the aerial mosaic map at a big saving in time and expense. Aerial patrol probably has as many advantages to the pipe liner as has aerial photography, but it undoubtedly will require a similar "breaking in" period.

Aerial patrolling is now being done both by company-owned planes and by independent contractors, the trend being toward the latter method. Contract patrolling was first based on a certain price per month or per flying hour, which procedure was advantageous to the contractor but not to client. Later contracts specify payment at so much per pipe-line mile, usually 20 cents, and obviously a much better arrangement for the client.

Without actual experience, it is almost impossible for the pipe liner to visualize that line walking can be done from the air far more successfully than on the ground. It is difficult for him to conceive that a small oil leak can be spotted from the air, but it can be done and is being done very successfully. There are two good methods the pipe liner can use to convince himself of the aerial patrol's feasibility. He can accompany the pilot to observe personally some known condition, let a patrolling contract for a 60-day trial period, or both.

At 20 cents per pipe-line mile, the aerial patrol can cover a line four times a week at approximately the same cost as ground line walkers who normally cover the line but once a week. Apparently, therefore, it would appear that the aerial patrol is much cheaper, if the coverage frequency is less than four per week. Usually, however, it is highly desirable to have four coverages per week, especially on old lines where leaks are frequent.

Even on a four-coverage-per-week basis, there are numerous economic advantages of aerial patrol. Leaks are found much quicker, resulting in savings from oil loss. Perhaps the most important factor is the time saving in the event of a line break or sudden pressure drop from a large leak. The plane can cover the section in a matter of minutes, frequently locating the trouble before the repair gang can be assembled. Not only are there savings in man hours locating the leak, but there are savings in pumping time which often are of extreme value.

Rarely does a ground line walker have an opportunity of reporting leaks of any consequence. Most leaks occur when the line walker is at some other place and are reported by farmers who might happen to see them. In sparsely settled areas, a leak may go undetected for days. Prompt detection possible by the aerial patrol not only reduces oil loss but land and crop damages as well.

Aerial patrol enjoys a distinct advantage during wet weather and floods. When the ground line walker's path is barricaded by swollen streams, the part of the line that needs patrolling worst is likely to be neglected. Not so with the winged line walker. He can inspect all of the line in spite of high water.

In a given length of time the aerial patrolman will report several times as many reportable incidents as would a ground patroller, not only because he covers the line more often but because he can see more. There are many things to report other than leaks. Some of them are erosion, road grading, pond building, construction work, and tampering. The airplane is useful for transporting employes and scouting routes for new lines.

One might surmise that bad weather would cause many flights to be canceled. Such, however, is not the

Top and bottom views illustrate how location of the pipe line is observed from the air by difference in the color of vegetation. Center view shows oil leak from pipe line. Photographs were taken by Paul Reed from a patrol airplane flying along pipe-line routes which are not part of the Empire Pipeline Co. system

Harry Nelson, acting manager, Empire Pipeline Co., graduated from Kansas State College in 1923. After several years in the civil engineering department of Empire Gas & Fuel Co., he became resident engineer at Oil Hill, Kans., shortly before assignment as resident engineer on the 250-mile 20-in. natural gas line from Pampa, Tex., to Wichita, Kans. In October 1937 he was transferred to Empire Pipeline Co. In 1942 he was promoted to general superintendent and later to his present position.

case. It may be necessary to postpone a flight for a few hours but rarely are they canceled entirely. One contractor, who started patrolling 400 miles of line April 15 of this year, has covered his assignment four times each week without missing a single flight. In addition he has had several emergency calls to locate line breaks. This excellent record probably is not possible during the winter months when there are fewer hours of daylight.

A high-winged monoplane is best suited for pipe-line patrol since it affords the best visibility looking straight down. It should have a slow cruising speed, preferably under 70 m.p.h. Altitudes of 400 ft. or under provide excellent visibility. Radio equipment would be useful in case of line breaks, but it is not now generally used. A system of ground signals at pump stations serves very well when contact is desired with the pilot. The pilot can drop messages at pump stations or land at the nearest airport for emergency communications.

Although a pipe line has been in the ground for many years, it is easily followed from the air. Soil and vegetation discoloration marks its location plainly. In order for the pilot to report locations of leaks accurately, mile posts with large numerals visible from the air are desirable. Black numerals 4 in. high painted on the side of a 3-in. pipe previously coated with aluminum make satisfactory markers.

Perhaps in the postwar era of marvels we are continually hearing about, the helicopter will provide the ideal means of pipe-line patrol. The helicopter may also be the means of transporting the repair crew and equipment into inaccessible places.

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Booklet Points Out Dangers Of Hydrogen Sulfide

Carelessness and failure to take proper precautions to avoid exposure to hydrogen sulfide have resulted in several deaths and many serious injuries from this extremely toxic gas, the Bureau of Mines emphasizes in a new publication calling attention to this hazard in the petroleum industry.

Because of the more widespread use in recent years of "sour" or high-sulfur-content crude oils in the production of petroleum products, the chances for exposure to hydrogen-sulfide poisoning have increased greatly in the oil industry the publication states.

Although the "sour" crude oils have been known to give off the dangerous hydrogen-sulfide gas during the producing, transporting, storing, and refining processes, the finished petroleum products — fully refined and ready for market—are free of the gas.

For more than two decades, the Bureau of Mines has conducted research on the toxicity of hydrogen sulfide and the hazard has been found present in more than 50 occupations. Although carbon monoxide commonly has been considered as extremely toxic, bureau studies have shown that hydrogen sulfide is five or six times as toxic as CO.

Hydrogen sulfide, a colorless, inflammable gas having an offensive odor, exerts a marked irritant action upon the cornea of the eye even in low concentrations, and in larger concentrations causes asphyxia and even death. The bureau publication describes the physiological action of the gas, treatment for hydrogen sulfide poisoning, preventive measures, and detection in air.

A copy of the publication, Information Circular 7329, "Hydrogen Sulfide Poisoning as a Hazard in the Production of Oil," by Sara J. Davenport, may be obtained by writing the Bureau of Mines, Department of the Interior, Washington 25, D. C.

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A Short Study of Gathering-Line Salvage

by D. Y. Hewitt

SOME years ago the writer was requested to ascertain whether it was advisable to salvage a rather extensive gathering system in an area of depleted production, replace same with lines and pumping equipment of less capacity, and reuse the salvaged material in a new flush producing area. The entire procedure was recommended and fortunately, in light of later events, it proved to be a good move. Study of the problem brought to light some negative facts that have been a guide to subsequent procedures, not only as to field operations and engineering, but between company agencies such as accounting and tax departments.

There are several reasons for reducing capital investment in a given gathering area all for the purpose of reducing operating costs. If an area has been depleted to 10 per cent of its original runs over a period of years, considerable savings in depreciation per barrel can be incurred; likewise maintenance, repair and sometimes manpower requirements can be decreased by the reduction of pipe size and horsepower requirements. Pumping equipment can be reduced to a minimum by careful redesign of lines to take advantage of gravity conditions not previously used. Mention is made of these results only superfically to show the desirability of carefully studying the results of any survey.

A hypothetical case may be used to illustrate. The reader will feel that this case is rather an extreme one, which it is; on the other hand it closely resembles known conditions in limestone production where poor producing practices resulted in excessive drop in production and corresponding gatherings, in comparatively few years. A gathering system was installed with a capacity of 20,000 bbl. per day. At the end of 4 years, the system was gathering 2,000 bbl. per day. The original investment was $150,000 and after 4 years was depreciated to $98,400. The latter figure included some small additional capital expenditures made from time to time.

Depreciation averaged over the 4-year period 0.0069 cents per barrel, but in the first year it was only 0.0021 cents per barrel while in the fourth year it was 0.0150 cents. This feature alone made it highly desirable to reduce somewhere along the line. If it were possible to reduce the value in the area from $98,400 to say $70,000, a reduction in depreciation costs would result, amounting to 0.0054 cents per barrel. This would be a substantial start, but unfortunately it could not be done in this instance.

D. Y. Hewitt, vice president, Simrall Corp., was born January 14, 1909, in Tacoma and attended high school in Los Angeles. From the Mackay School of Mines, University of Nevada, he went into refinery work and in 1933 came to Michigan as assistant superintendent of Roosevelt Oil Co. In 1935 he became superintendent of Simrall Corp. and in 1942 vice president in charge of operations and a director of the company. During service with Simrall he was general superintendent of Michigan Toledo Pipe Line Co. an affiliated company, 1935-41, and superintendent of construction for Sohio Pipe Line Co.'s eastern division in 1940 when Sohio's 10-in. and 12-in. crude-oil system was built from Stoy, Ill., to Lima, Ohio.

The first step in determining the exact picture of the foregoing area was to set up a value for laying costs of replacement pipe lines, salvage costs of existing pipe lines and selling prices on used pipe. The following schedules of prices were based on force account costs, and while today they may seem low in comparison, they are fairly average from past records. The pipe prices were based on OPA normal ceilings. To analyze any case it is only necessary to substitute actual known costs that the reader is familiar with and obtain his result for better or worse.

Laying costs:

6⅝-in. line pipe	0.350 per ft.
4½-in. line pipe	0.200 per ft.
3½-in. line pipe	0.150 per ft.
2½-in. line pipe	0.120 per ft.

Salvage costs:

6⅝-in. line pipe	0.20 per ft.
4½-in. line pipe	0.14 per ft.
3½-in. line pipe	0.10 per ft.
2½-in. line pipe	0.08 per ft.

Value of used line pipe:

6⅝-in. line pipe	0.538 per ft.
4½-in line pipe	0.332 per ft.
3½-in. line pipe	0.236 per ft.
2½-in. line pipe	0.114 per ft.

Continuing, let it be assumed that the case under study incorporated the following equipment with the depreciated values listed accordingly.

60,000 ft. 6⅝-in line pipe at 0.60	36,000
80,000 ft. 4½-in. line pipe at 0.40	32,000
Valves and fittings	8,200
Storage facilities	12,000
Pumping equipment	10,200
Total	98,400

The main items that could feasibly be reduced in the foregoing listing were pipe and pumping equipment, with a possibility of some storage reduction, although trunk-line requirements precluded this particular possibility. Of the $98,400.00 investment, it would then be necessary to deduct the items not subject to revision. (1) Valves and fittings while necessarily changed in size would continue to represent approximately the same value and (2) storage facilities. This would give a total deduction of $20,200 or a net book value subject to revision of $78,200. Total book value after revision as aforestated was to be $70,000. Deducting the same $20,200 from the $70,000 would leave a balance of $49,800 as expendable in the revision program.

By reducing all 6⅝-in. pipe to 4½ in. and all 4½-in. to 3½-in. pipe, the following would give an indication of expected results.

(a) 60,000 ft. 4½-in. line pipe at 0.532 per ft. laid	31,920
(b) 80,000 ft. 3½-in. line pipe at 0.386 per ft. laid	30,880
Cost of salvaging old 6⅝-in. and 4½-in. pipe at 0.20 and 0.14 per ft. respectively	23,200
Total	86,000
Less sale of salvage pipe:	
60,000 ft. 6⅝-in. line pipe at 0.538	32,280
80,000 ft. 4½-in. line pipe at 0.332	26,560
	58,840
Cash outlay	$27,160

Items (a) and (b) totaling $62,800 now represented the book value of pipe installed. By the addition of the $20,200 fixed asset items a total investment of $83,000 was in the area, and it had cost a cash outlay of $27,160. It is reasonably impossible to assume that all the pumping equipment could have been salvaged, and even if it were salvaged and sold at book value plus salvage cost, an investment of $71,000 would still be on the books. It is to be concluded that the foregoing plan of revision is definitely impractical on its own merits. By juggling other pipe sizes and reduction of pipe requirements it is still possible, although not probable that a figure

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approaching the $70,000 over-all figure could have been reached. This, of course, would be a matter of careful study both as to design and costs.

The real catch in the problem is not so much in the revision of the system, as in the loss on sales of depreciable assets. An analysis of this side of the picture reveals the following results:

Original cost of 4½-in. and 6⅝-in. pipe, fittings, storage and pumping equipment	150,000
Depreciation over 4-year period	51,600
Book value	98,400
Cost of salvaging pipe 6⅝-in. at 0.20 per ft. and 4½-in. at 0.14 per ft.	23,200
Total	121,600
Less sales price of salvaged pipe 6⅝-in. at 0.538 per ft. and 4½-in. at 0.332 per ft.	58,840
Loss on sale of depreciable assets	62,760
Less fixed assets remaining in use	20,200
Net loss	42,560

In summing up the results of the foregoing analysis, it is obvious that under normal conditions the feasibility and practicability of the revision of a gathering system once installed is dependent entirely on the cost of salvage and relaying lines versus the sales price of salvaged material and on the rate and number of years of depreciation that have been claimed on the original investment.

There are certain instances where the foregoing example installation would still be the proper procedure in spite of the economic absurdity apparent to the eye. These instances are purely in those cases where a write off to a company of a large loss on sale of depreciable assets would reduce tax liabilities sufficiently to warrant not only the write off, but the additional expenditure as well.

Improvised Equipment Used in China

A variety of material was used in improvising equipment for the India-China line. Jeeps proved too small to handle the movement of personnel which was necessary as the pipe line moved along in China. Men of one outfit found that they could weld together two wrecked jeeps, extend the frame and crankshaft, and construct a vehicle capable of carrying 18 men in comparative comfort.

Jap 150-mm. shell cases formed a foundation for storage tanks in muddy areas. Tools were manufactured in the field. Army rubber boots were utilized to make gaskets when special gaskets for gate valves along the line did not arrive. Old gasoline drums that needed rewelding were dangerous because of the gas fumes which remained behind after the fuel had been used. An old boiler from a sugar mill was used in steam-cleaning drums before welding.

Some of the ingenuity displayed by the pipe liners went into improving their own comfort. One outfit built its own water system supplying running water to every tent. Not long after the fall of Myitkyina an imaginative soldier found some old parts in the city's wreckage and built an ice plant which delivered 1,600 lb. of ice to his company each day. A sawmill was built from salvaged material by a man who had never seen a sawmill before. One soldier had an air-conditioned tent

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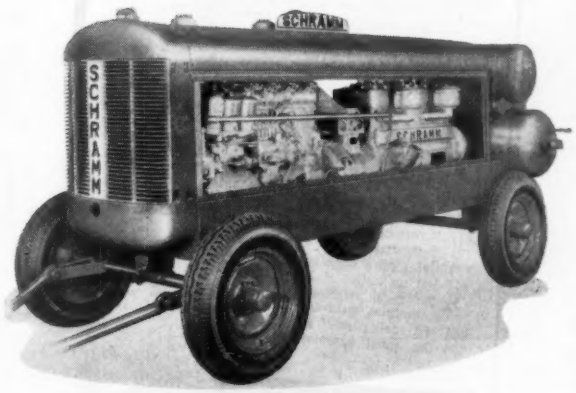

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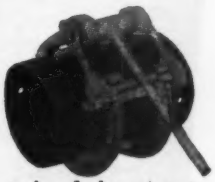

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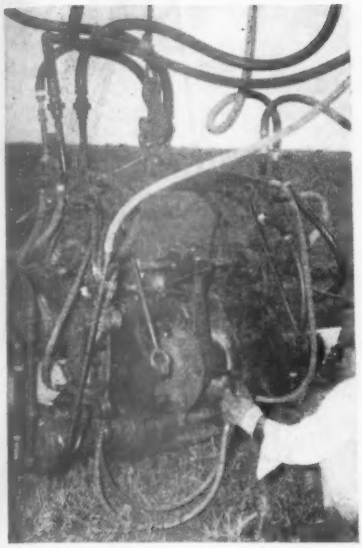


Left: Pressure weld clamp in position on 5½-in. pipe laid for Humble Oil & Refining Co. line. Right: Texas-New Mexico Pipe Line Co.'s 12¾-in. line laid with pressure welding along rough right-of-way

Pressure Welding Proves Its Versatility

by E. P. Jones

DURING the past winter and spring the Pressure Weld Co. has welded several pipe lines which were interesting from the standpoint of providing comprehensive operating tests to the pressure-welding process and equipment, under exacting field conditions.

Among those pipe lines was a gathering system of 3-in., 4-in. and 6-in. pipe for Trinity Gas Corp. at Hebbronville, Tex.; 81 miles of 4½-in. o.d. pipe line for Dow Chemical Co., Freeport, Tex.; 30 miles of 12¾-in. o.d. pipe line for Texas-New Mexico Pipe Line Co. between Katy and Crane, Tex., and 32 miles of 24-in. o.d. pipe line for Panhandle Eastern Pipe Line Co. in eastern Indiana and Ohio.

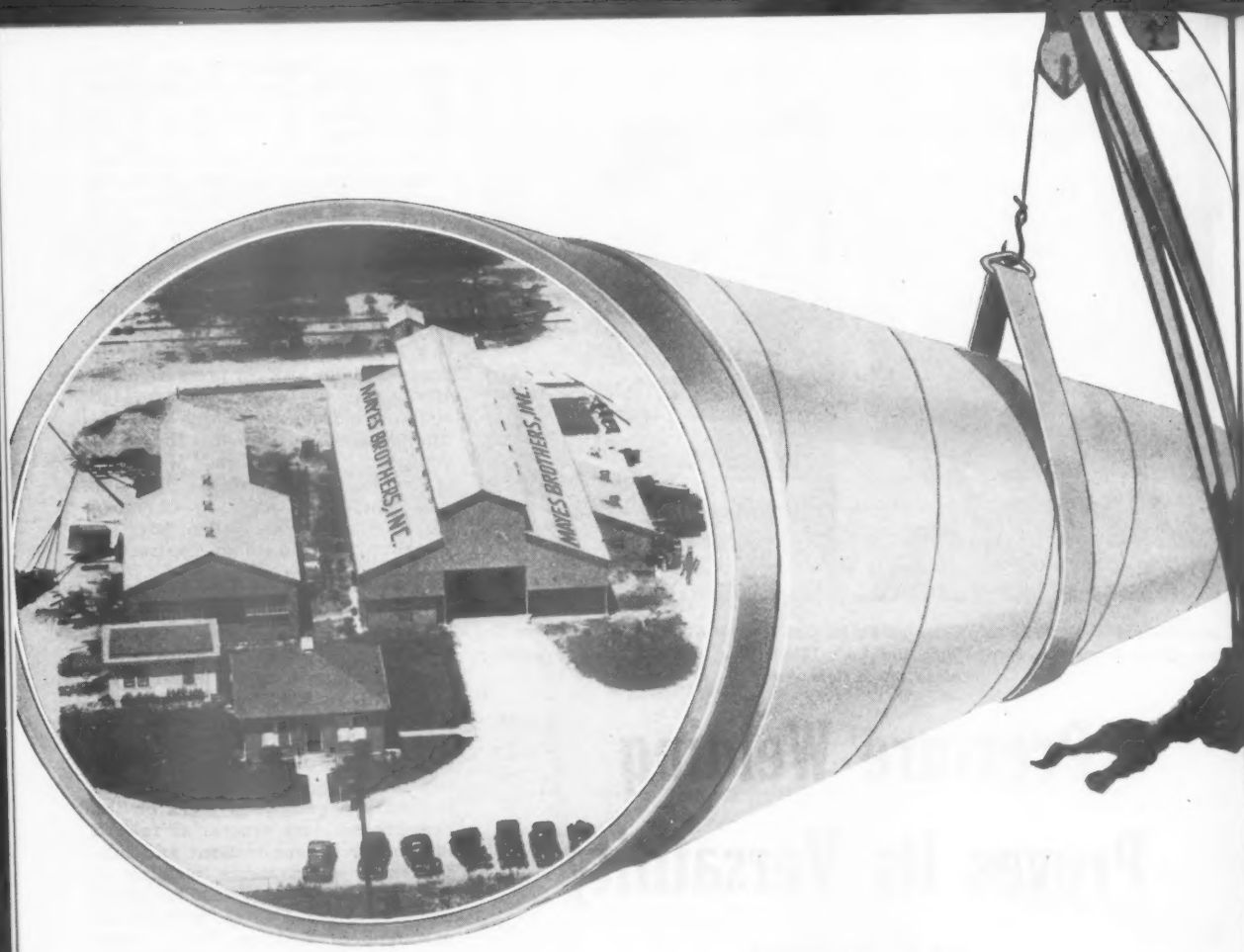
The welding for Trinity Gas Corp. consisted of a complete gathering and injection system for a recycling plant. The 3, 4 and 6-in. pipe was of various wall thicknesses up to 9/16 in. On completion of the work a cold water test of 3,400 psi. was placed on the 3 and 4-in. Schedule 80 pipe and 4,000 psi. on the 6-in. Schedule 100 pipe for a period of 18 hours without leaks or pressure drop. Here pressure welding provided sound welds in this high-pressure piping using the standard field procedure.

The 4½-in. o.d. propane pipe line was constructed for Dow Chemical Co. by Sharman and Allen, later reorganized as Associated Contractors and Engineers. Pressure welding was started on February 24 and a second machine was placed in operation on March 7. On March 27 the welding was completed on the 81 miles of pipe line. This would not be considered unusual except for the nature of right-of-way conditions. The pipe line was laid largely across the soft ground of rice fields and across numerous drainage canals. In addition, 45 road and railroad crossings were made that required casing. There were seven overhead suspension canal crossings and two large bayous which required dredging operations. At completion of construction a go-devil was run through the line and a hydrostatic test of 2,300 psi. was applied for 48 hours without leaks or pressure drop.

The 30 miles of 12¾-in. o.d. loop lines for Texas-New Mexico Pipe Line Co. were located at various intervals along its system between Katy and Crane, Tex. This right-of-way was particularly rough. Practically all trenching on the loops west of Wimberley, Tex., was done by blasting. During this construction by Stanley-Bledsoe Construction Co., the pressure-welding oper-

Tractor and clamp equipment for pressure welding Dow Chemical Co.'s 4½-in. propane pipe line

Everett P. Jones pursued a mechanical engineering course at the University of Alabama with additional graduate work at Stevens Institute of Technology. He was employed as development engineer with The Linde Air Products Co. from 1936 to January 1, 1945. During this time he handled much of the early development work on the pressure welding process as related to commercial applications and subsequently the pressure welding of pipe lines. In January 1945 he joined Pressure Weld Co. as general superintendent and on June 1 was promoted to manager of the company.



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ations progressed as fast as the trench could be opened. The roughness of the right-of-way in no way impeded the welding operations. When the loops were tied in, a hydrostatic test of 800 psi. was applied without leaks or pressure drop.

At the present time construction is proceeding on the second of two loop lines for the Panhandle Eastern Pipe Line Co. system. This line is 24-in. o.d. by 9/32-in. wall thickness pipe which is contracted by Midwestern Constructors; 3,500 ft. of this big-inch pipe is being laid each day with a minimum of personnel and equipment.

Construction is also under way on approximately 16 miles of 5½-in. o.d. and 7-in. o.d. pipe line for Humble Oil and Refining Co. by Associated Contractors and Engineers. This pipe is used oil-well casing which was double jointed by pressure welding and coated and wrapped before stringing on the right-of-way. The pressure welding process again proved its versatility by joining this high-strength alloy pipe under right-of-way conditions.

Considerable work has been undertaken to simplify and provide more automatic operation with the pressure-welding clamps. The new-style welding clamp for 4 and 6-in. pipe weighs only 900 lb. in operating condition. Changeover from one pipe size to another is accomplished by changing the insert-type gripping dogs and the welding heads.

New pressure-welding clamps also have been constructed for the large-diameter pipe sizes. During construction of these clamps special precautions were taken to hold to close tolerances the parts related to gripping the pipe. By so doing, speedier and more accurate alignment of the pipe in the machine has resulted.

In order to control to closer limits the upset produced during welding and to insure obtaining a minimum of excess metal, electric limit switch equipment has been developed. When the required movement to produce the proper pressure weld upset has been obtained, the limit switch automatically operates so that the hydraulic pressure is released from the "endo" cylinders of the machine. Each weld is also identical with the preceding one with this procedure.

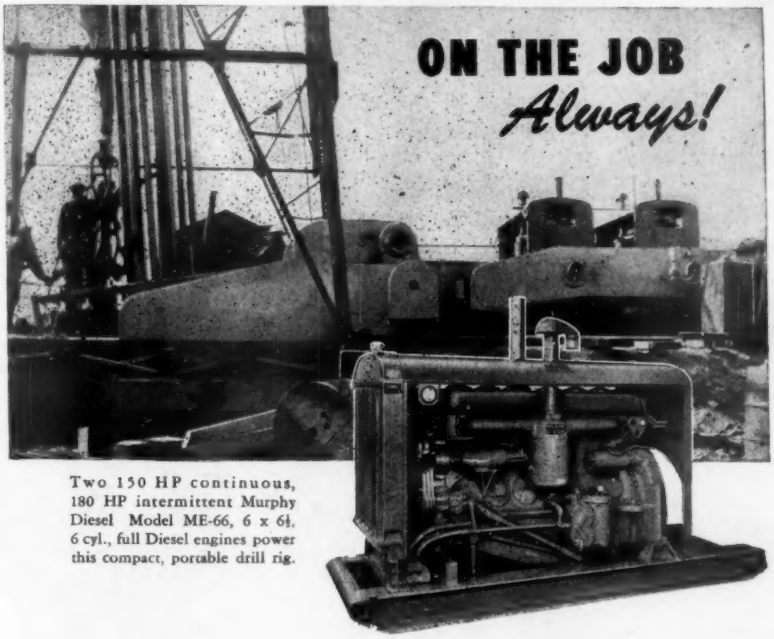
During the past fall and spring two Pressure Weld schools were operated in conjunction with Linde Air Products Co. Over 90 men from 43 oil, gas, and contracting companies attended.

Care of Tools at Pump Stations

Studies of the causes of accidents at pipe-line pump stations have indicated that many injuries can be avoided by establishing policies regarding the care and handling of certain types of tools.

Some superintendents have electric grinders only located at division shops and as part of the equipment of traveling mechanics. These superintendents have prescribed that tools requiring dressing generally be sent from pump stations to division shops where the work can be done by skilled men. In using hand-operated grinders at pump stations, measures have been taken to see that holders are placed sufficiently close to grinders to insure safety. Goggles should be cleaned before storing in a box. The box should be conveniently near the grinder.

Although it has been recognized for a long time that it is safer to leave ladders unpainted there are still a number of painted ladders found at pipe-line stations. Painted ladders should be carefully inspected. Some companies have specified that ladders be suspended rather than left leaning against a wall when not in use. Warning has been given against leaving buckets and other objects on the tops of ladders. The ladder may be moved by someone who has not noticed that such a hazard exists which might lead to an accident by falling.



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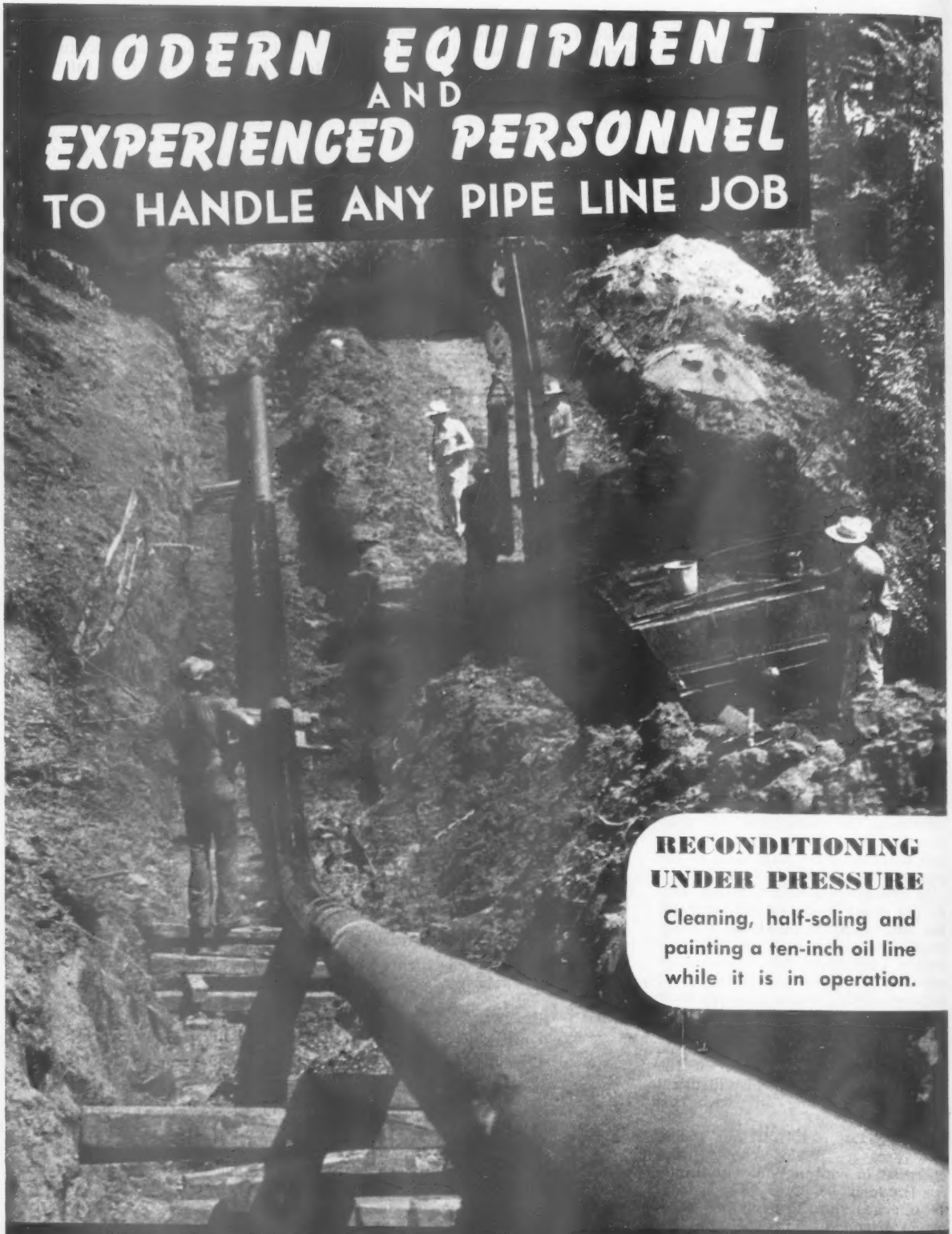

RECONDITIONING UNDER PRESSURE

Cleaning, half-soling and painting a ten-inch oil line while it is in operation.

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Pipe-Line Coatings Tested For Dielectric Strength

by E. A. Koenig

YEARS ago it was apparent that much must be done to improve the results of pipe-line coatings. This would be to justify the costs involved. Coating manufacturers began a study to improve their materials, and contributed materially. The greatest contribution has been through the development of the coating and, or, wrapping machines. These machines make it possible to apply coatings with or without wrappers to a high degree of perfection. Such perfection cannot be approached by hand application. Neither can hand application keep up with the speed required in modern pipe-line construction. Anyone having had experience with coating applications is well aware of the important part these machines are playing. Also, if these machines were not available, coatings might have been forgotten by this time as an unsuccessful experiment.

Pipe cleaning has also been greatly simplified and improved and is being accepted as of prime importance. Priming of pipe lines to facilitate bonding of the coatings needs further improvement. The success of any primer depends on clean, dry pipe. Some primers are too critical with respect to any or all of the following: slight traces of moisture, dust, grease, light rust films, etc. Considerable difficulty is encountered trying to obtain a bond to the pipe that will be lasting. Often the bond is harder to obtain on loaded lines. Failure to bond to the primed pipe is seriously affected by primed pipe sweating or from any traces of: moisture, dust from right-of-way travel, or primer that is not properly seasoned or cured. Many of these obstacles have been materially reduced through close inspection and good efforts to dry and clean, but much depends on the bond to the pipe for the success or failure of any coating. If the bond is poor and an accidental puncture in the coating results in this area, moisture will accumulate between the coating and the pipe and cause a rapid failure of the coating and the pipe at this point.

E. A. Koenig left Magnolia Pipe Line Co. in June 1945 to become a consulting engineer. While with this company he was corrosion engineer, from June 1935 until September 1939. He continued to be corrosion engineer while he was also superintendent of butane-gasoline pipe lines for the remainder of his service with the company. Prior to being with the pipe line company, he was employed by Magnolia Petroleum Co. in the following capacities: district superintendent, natural-gas and gasoline department, Olden, Tex., June-December 1931; chief engineer, natural-gas and gasoline department, Dallas; sales department, construction of bulk terminal, dock facilities, etc., January-June 1935. Koenig started with Magnolia Gas Co. in 1924 and served in various capacities in drafting, construction and as chief engineer of a station. After the properties were acquired by United Gas Pipe Line Co., he was assistant superintendent of natural gasoline plants, June 1930-June 1931. After graduating from high school at Bryan, Tex., in 1921, he studied mechanical and chemical engineering at Texas A. & M. College for 3½ years; he returned for one term from Magnolia Gas Co. service.

Coated 18-in. line with Fiberglas wrap, laid in 1939 and inspected in January 1945

Importance of Clean Pipe

Therefore, too much stress cannot be placed on the importance of clean pipe, priming, and the bonding of the coating to the pipe.

Often pin holes and air bubbles are formed in a hot coating application and are sealed over in the pipe coating. Upon cooling, the pipe appears well coated, even from holiday test inspection. These bubbles or pin holes come from such conditions as: products of corrosion in poorly cleaned second-hand pipe, dust, green primer or primer solvent, moisture, and even sometimes air is trapped with the coating and wrapping operations. Some of these obstacles can be and are eliminated by the continued vigilance of personnel coating and inspecting such operations. However, this becomes

Top: Contours and air space evident in photograph with 200 magnification. A film of coating was previously over the outside of this sample. Center: Grain structure and stresses often observed in samples where cracks, crevices, pin holes and small drops of moisture may be observed. Photographed with 200 magnification. Bottom: Pipe surface can easily be detected through the voids after removing the outer sealing film

a most trying and tiring task to most people.

Several years ago, the writer became interested in the use of some porous type of wrapper to assist in removing some of these defects, to reinforce the coating and to help build a thicker, more uniform coating film to resist soil stress and corrosion action. Open-weave cotton fabrics were tried but they are organic and will eventually rot. Battery-mat type of fiber glass was tried by saturating the materials similar to methods for other wrapping material.

By using a line-type coating and wrapping machine, the following specifications were followed and subsequent tests made with the following results:

	Asphalt bonded Fiberglas mat		
Sample—	1	2	3
Av. wt. of 3 samples each per 1,000 sq. ft.	56.7	76.7	88.5
Nominal thickness in in.	.018	.022	.028
Coating spec.: primer, hot coat 400° F. (glass or asbestos wrapper). Kraft paper spiral wrap.			
Spark dist. gap. test, in.	5/8	3/4	1
Total coating and wrapper thickness	.088	.091	.099

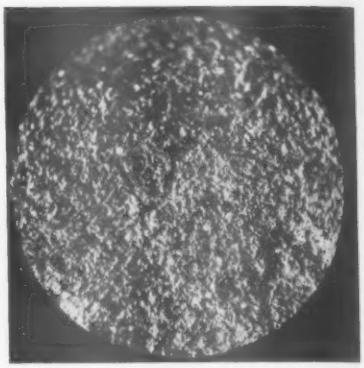
To check our field tests and to determine numerically the relative compatibility of coating and Fiberglas and coating and other wrapping materials, samples were prepared in the laboratory by dipping sheets of Fiberglas in molten coating at approximately 225° F. until various thicknesses were built up. These samples were then tested for dielectric strength with high-voltage direct current. Direct current was used because it eliminates the error due to dielectric loss. Furthermore, electrolytic action is primarily concerned with direct currents. From these tests the following data were obtained:

FIBERGLAS MAT BASE

Sample No.	Thickness of sample in.	Breakdown voltage kv.	Volts per mil
1	.165	No failure at 110 kv.	
2	.120	100	835
3	.100	92	920
4	.085	81	955
5	.070	92	1,300

Normally in the testing of dielectric materials it may be expected to find an increase in breakdown voltage expressed in volts per mil as the thickness of the sample decreases. Where this occurs it is an indication of uniformity of the dielectric materials. With respect to the glass samples, it was found that as the thicknesses of the materials decreased, the dielectric breakdown increased continuously to 1,300 volts per mil for the thinnest sample. Incidentally, our experience told us that this is an unusually high dielectric strength, as insulating impregnants go. Furthermore, note that the breakdown voltage of the thinnest sample of glass (0.070 in.) is 92 kv. In all cases, each of these tests represents the average of at least five measurements. These data prove beyond a reasonable doubt the high compatibility of coating and Fiberglas.

Both field and laboratory tests show the superiority in electrical properties of pipe covering where



Fiberglas reinforced coating. Note the absence of air and pin-point holes, uniform grain structure of coating. Photograph was taken with 500 magnification

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Fiberglas was used regardless of the weight of the Fiberglas mat. In the manufacture of Fiberglas mat, the porosity is controlled to produce uniform bleeding through the coating during application. The tension in wrapping squeezes the coating on to the pipe and also causes the bleed through. Because of the foregoing, the air bubbles are forced out first. The glass fibers become imbedded in the coating and upon cooling of the coated mass, reinforces the resulting coating. The Kraft paper has a smoothing action and as a final wrapper helps form the coating as a uniform film until thoroughly cooled.

Ten miles of this type of coating with a glass reinforcing wrapper and Kraft over the outside was laid in 1939. This was inspected in 1945 and was found to be in excellent condition.

In conclusion, a 12-in. o.d. roll with 2-in. i.d. spindles, 12 in. wide, contains 450 lineal feet and weighs approximately 5 lb. Therefore, it is light and easy to handle. Also, it may be wrapped into and becomes a thorough part of a grease, asphalt, or coal-tar base coating. It improves the bond, eliminates pin holes and air bubbles, and reinforces the coating. It is of a basic, inert material—glass. Since the glass wrapper becomes imbedded and thoroughly incorporated into the coating, and because of its stable nature, it will last as long even longer than any other coating.

Protective Materials Used on Large and Small-Diameter Lines

Within the last year Fiberglas has been used in connection with the protection of new and reconditioned lines of diameters ranging from 4 to 24 in. in diameter. Total length of such projects approximately 120 miles in Texas, Oklahoma, and Louisiana. Among the companies applying this material are: Texas-New Mexico Pipe Line Co., Humble Pipe Line Co., Magnolia Pipe Line Co., United Gas Pipe Line Co., Empire Pipeline Co. and Continental Pipe Line Co.

Glass fiber and kraft paper wrapped on coating by dope machine for Magnolia Pipe Line Co. by Oklahoma Contracting Co.

Colorimetry-Photometry Symposium Released

PHILADELPHIA. — Reprints of the symposium on colorimetry and photometry, sponsored by Committees E-2 and E-3, American Society for Testing Materials, are available from the society, 260 Broad Street, Philadelphia. Two divisions of the symposium are the instrument section and the chemical section.

The instrument section covers the subjects of trends in analytical chemistry; colorimetric analysis; filter photometers; glass photometric filters, and spectrophotometers. The chemical section discusses chemistry in colorimetry; colorimetric methods bibliography and several analytical methods such as those for aluminum-base alloys; magnesium-base alloys; other nonferrous alloys; also ferrous alloys.

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Pumping Various Products Through Same System

(Continued from page 198)

Now, if this theory can be applied to actual pumpings of various liquids, through the same pipe line, the length of the contamination stream would be proportional to

$$(O) \qquad \frac{D v \delta}{\mu}$$

and the Reynolds number of the liquid, which is advancing into the other liquid, should bear some relation to the amount of contamination to be expected.

Miniature Pipe-Line Tests

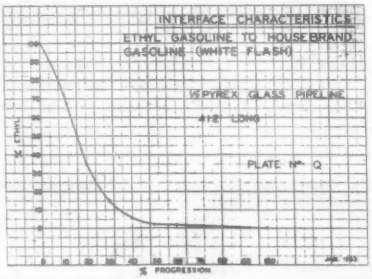
In order to make a test of the foregoing theory, Keystone Pipeline engineers in 1932 constructed a small glass pipe line built of Pyrex tubing. The line was laid out from a profile of Keystone's 8-in. pipe line which runs from Point Breeze near Philadelphia to Reading.

One-half-inch-inside diameter Pyrex glass tubing was used as the "pipe," the total length being 412 ft. The line held 4.21 gal. when full. The joints in the line were made by butting the ends together, wrapping the joint with cotton tape and then impregnating with celluloid dissolved in acetone. When this had dried, about 5 in. of rubber tubing was slipped over the joint, the rubber wired near the ends, and the whole joint covered with two layers of tape treated as above.

The glass tubing was erected on wooden uprights, 2 ft. apart, in two rows 56 ft. long. Owing to the constantly increasing elevation of the profile, it was possible to spiral the line around the two rows of uprights without any two circuits interfering with each other. Bleeder valves were set in the glass tubing at suitable points, so that air might be released while filling the line for the first time. A small rotary pump, driven by an electric motor, was installed for pumping. Pressure gages were also installed at strategic places. The suction line from the pump was made of ½-in. rubber hose so it could be lifted from one container to the other without greatly increasing the contamination. Plate P shows how the completed glass pipe line appeared during the tests.

After construction was completed, gasoline was pumped through the line and after all the air had been exhausted, tests were made with different liquids so as to observe the contamination. Through the use of the glass tubing as the pipe it was possible to observe the different colored liquids progressing through the line and to observe the mixing effect, as well as the increasing length of the contamination portion.

The entire "pumpings" of the line were gathered at the end of the glass pipe line in 4-oz., cut bottom bottles, so that a complete picture of the interface between the two liquids was available for study. The use of the 4-oz. bottles made it possible to compare very accurately the glass line samples with prepared mixes of various percentages and so evaluate the intensity of the mix. A contamination curve, marked Plate Q illustrates the results of the

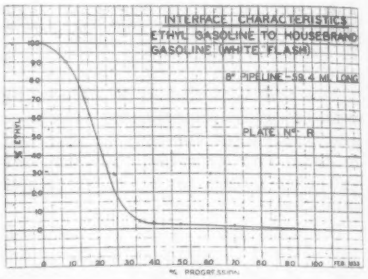


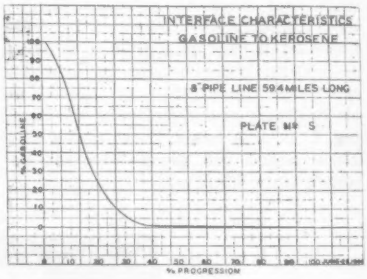
examination of the contaminated portion and it can readily be seen that the curve belongs to the same family as the one obtained by mathematical means.

Considerably more work was done in connection with other products, gasoline, furnace oil and the use of buffer naphthas.

Practical Application

After having proved the theory with the use of the glass pipe line, experiments were carried forth in the main trunk line of Keystone's products pipe line. The line from Philadelphia to Reading is 8-in. seamless steel pipe and the interior of the pipe throughout the whole length is as nearly smooth as it is possible to obtain in a commercial venture. The section through which the trunk line tests were made is 59.4 miles in length and rises from sea level to an elevation of 400 ft. at Reading. The interface characteristics for various combinations of product pumpings were taken at regular intervals. Complete tests were made on these samples, representing the interface and the percentage mixture was plotted against time. Plate R shows the interface





characteristics for a pumping of two different types of gasolines and Plate S shows the interface characteristics between a pumping of gasoline and kerosene. Here again, it can be readily seen that the characteristics are similar to those curves obtained in the glass pipe line study and also to those curves obtained by plotting the theoretical data. It may be of interest to note that one of the things we found on the Keystone Pipeline was that anything that could be pumped to Reading without excessive contamination could be pumped to any point on the pipe line and a whole range of products including gasolines, kerosenes, household furnace oils, and gas oils are pumped through the Keystone system for eventual delivery to Pittsburgh, Cleveland, Buffalo, Rochester, and all points in between.

The Little Big-Inch

The same principles involved in the foregoing discussions were applied to the operation of big and little-inch. The little-inch represented the longest and largest pipe line on which we have had the opportunity to make contamination studies. The same method of sampling and the evaluation of the contamination was used and two typical

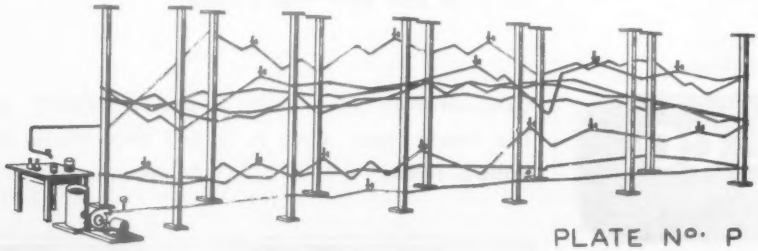


PLATE Nº. P

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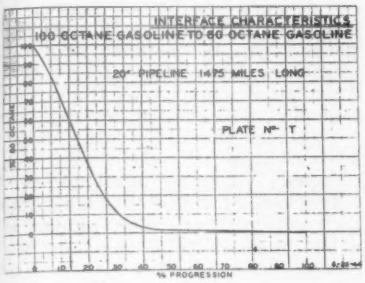
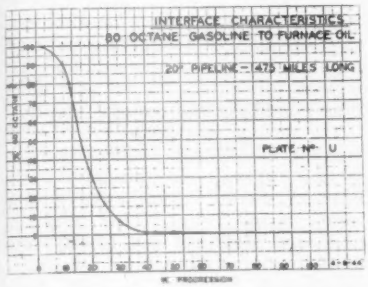
curves are shown here. Plate T shows the interface characteristics for two types of gasolines and Plate U shows





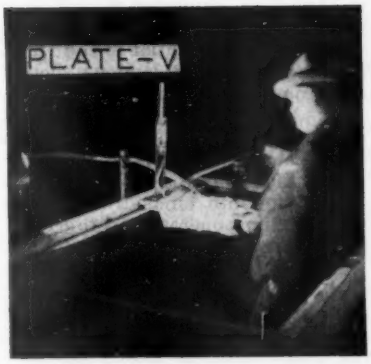
the interface characteristics for 80-octane gasoline and furnace oil. Here again there is no question that the curves are of the same family as those which can be produced by mathematical means.

The reader should bear in mind that experience to date covers only miscible liquids.

It can be seen from the foregoing that the products-pipe-line operator, with a knowledge of the characteristics of his line, can, with the aid of integral calculus, actually produce a contamination curve for the materials he proposes to pump, long before the movement is actually made. With the aid of contamination curves, representing the interface characteristics, the pipe-line operator can determine the point at which it will be necessary to make the "products cut." That is to say, the point at which the flowing stream will be diverted from the tanks containing one product to the tanks containing the product following in the pipe line. With this method and the use of a polar planimeter accurate estimates of the volume of the contaminated material that can safely be disposed of in each of the products which make up the contaminated portion, can be made.

Most modern products pipe lines are built with the facilities at hand for successfully handling many different grades. As a matter of interest, there is included a picture (Plate V) showing the crude methods used in 1932, contrasted with the small but complete laboratory facilities (Plate W) which exist on the little big-inch.

The writer wishes at this time to express his thanks to W. H. Still of The Atlantic Refining Co. for his untiring help and valuable advice during our 14 years of association on the subject matter.



Testing for the change of grade. Top, circa 1932. Bottom, Little Big Inch, 1945

Design of Station Piping For New Construction

(Continued from page 196)

lines. Construction of other lines to new destinations and decline in crude supply from original sources compelled the pumping of two grades south and one grade north. For the past 4 years all of the crude passing through this point has been pumped north. It is quite possible that some situation will arise in the future wherein pumping simultaneously in both directions will be required.

Plate 2, representing a piping diagram of a trunk-line booster station, is presented to illustrate the construction of piping facilities in progressive stages to expand or reverse operating conditions provided for in the original design.

The piping initially installed indicated by solid lines consists of facilities to pump in the direction indicated through a single line with two reciprocating pumps. Only one tank is used as a surge chamber inasmuch as the crude stream is floated on the suction and filling line. In addition to the combination suction and filling line, a separate filling line is provided. This line is not used in normal operations, but only when scrapers are being received to handle excess paraffin, to carry a water plug introduced into the trunk line during repair, or to handle excess air resulting from a line break. These two tank lines will also provide for conversion to a hydraulic speed governor closed system merely by the installation of a relief valve on the filling line and a check valve on the suction line. Note connection indicated as No. 1 station bypass. While the station could be bypassed by a connection between trunk lines, the arrangement, as shown, provides for check metering which is desirable when operating at reduced capacity.

Reducing Contamination

In case it becomes necessary to transport two crude grades, an additional tank may be added to reduce contamination or eliminate the necessity of pumping down No. 1 tank. This change can be accomplished by the addition of valves 1 and 6 on the No. 1 receiving header, and valves 4 and 5 on the two-pump suction lines.

If a second trunk line is the next step in increasing the capacity of the system, valves No. 38, 2, and 7 will be added on No. 2 receiving header. Valve No. 48 will be added to the station bypass. If it is necessary to manifold the receiving lines so that either grade can be worked through either tank, valves No. 9, 14, and 20 will be added. Additional valves may be added, if necessary, on the station bypass lines to switch No. 1 trunk line through No. 2 trunk line, or vice versa. No. 2 discharge header will be installed with valves No. 51, 52, 53, and 45, as well as valves No. 3 and 10 on No. 3 suction line.

In case the flow is reversed in No. 1 trunk line, valves No. 31 and 16 will be installed on the receiving and discharge headers, and No 17 on the station bypass line.

If the completed system is arranged, as shown, any possible contingency will be provided for.

A diagram of a two-unit centrifugal pump station operating on an entirely closed system is presented on Plate 3. The plant, as shown, follows the conventional design for this type of station, except for certain features that will be pointed out.

The crude stream moves in the

direction indicated by the arrows, with only one of either of the two units operating, or with both units operating in series. The position of the check valves between pump suction and discharge lines automatically adjusts the flow to either system of operation. A flow controller is shown to maintain minimum suction line pressure by throttling the discharge. The meter is located so that the stream may be metered if the station is operating or is being bypassed. If it is unnecessary to meter the stream while the station is idle, the stream may be bypassed through the connection between the trunk lines. Strainers are duplexed to permit continuous operation of the station while debris is being removed from one of the strainers.

Reducing Wear on Pumps

Some operators prefer not to install scraper traps, as shown, but follow the practice of shutting down the station while a scraper passes through to a terminal. The piping shown can be adapted to this method of bypassing by extending the receiving line and addition of a scraper wye between this line and the trunk-line discharge line. This system of operation no doubt will reduce the wear on centrifugal pumps.

An increase in pumping may be achieved by the addition of a third centrifugal pump unit or by increasing the pump-impeller diameter, providing the necessary additional horsepower is available from the prime movers, be they combustion engines or electric motors. No piping changes will be required in the latter case, while the addition of a third unit will require the installation of suction and discharge pump piping with a check valve between these lines in the same manner as indicated on each of the pumps shown on the diagram.

The direction of trunk-line flow can be reversed by the addition of valves No. 1 and 2. In case another complete parallel trunk line is added to increase throughput, main units would probably be added with each of the two trunk lines functioning as separate units.

Plate 4 illustrates the piping for a main field-gathering station. The suction and discharge lines from station pumps are connected as described previously. Each line from the field is connected through individual lines into each of the three tank lines. The four field lines shown can be connected into common filling header if one crude grade only is being gathered. In this case it may be advantageous to record receipts from each line by means of positive volumetric meters. If more than one crude grade is being received, all lines from the field must be connected to tank lines to keep these grades separate.

Since only one outlet to the trunk system is shown, a common suction line from the tank lines can be used. Tank lines can be extended and manifolded into pumps if more than one discharge outlet is used.

A suction pump is shown to boost the stream into tanks from any of the field lines operating as a gravity line.

At terminals where large stocks of several different grades are accumulated, the large number of storage tanks used will not justify the construction of individual combination suction and filling lines. Modern practice is to segregate groups of tanks for each grade of crude or product. Such a group of tanks is usually served by a common filling line and a common suction line. These lines can be manifolded at a central point to each individual tank line. The use of booster pumps on tank suction lines is meeting with increasing favor because they assure an adequate supply to the discharge or loading pump suction and reduce the diameter of suction lines.

At products terminals, valves are sometimes blinded off when not in use to avoid contamination. There is a type of coupling and blanking plug available which requires very little assembly time, and is being used by some operators for blinding off connections.

Types of Scraper Traps

A few piping details are shown on Plate 5. Two types of aboveground scraper traps are illustrated, both of which have been found to function satisfactorily. These are constructed aboveground to eliminate scraper pits. Valves and piping are arranged to receive or force scrapers into the trunk line without interrupting station operation. There have been occasions where a scraper made an abrupt right-angle turn into the side outlet instead of coming into the trap. This can be prevented by leaving a narrow strap in the outlet port when the opening is cut for this outlet.

A good drainage system will prove to be of great assistance in draining up the system in case repairs or additions become necessary in the station yard. All drain lines should be installed with bull-plug connections so that any stoppage in the drainage system can be cleared by the use of a cleanout rod.

A suggested sampling nipple design is shown which is self-explanatory. These should be installed on all receiving and main discharge headers.

The aboveground type of manifold, which eliminates manifold pits, is becoming increasingly popular. In several installations designed by the author, all suction, discharge, bypass, and receiving headers have been installed aboveground with valves located on side outlets which are dropped into bottom headers by means of 90° welding ells. Bottom headers can be installed above or at shallow depth below ground level. This latter method has the advantage that no runways are required.

Strainers should be used on all suction lines to reduce wear and eliminate pumping interruptions.

It is recommended that tank lines be connected into tank nipples at a 90° angle, with a valve on this connection and a header valve on the tank nipple. If another tank line is connected at some later date to receive a delivery from another carrier, the flanges connecting the tank nipple may be unbolted and removed for extension or any additional welding that may be required.

The author favors the use of solid welded manifolds without the use of any expansion couplings. All top headers should be equipped with a small spring relief valve to avoid excessive pressures due to exposure to the sun when not in use. Steel valves will probably be used more frequently to satisfy the higher operating pressures of the pipe line of the future. The same will probably be true of the ring-joint flange as compared to the raised-face or tongue-and-groove flange. Check valves with synthetic-rubber seats will give positive shutoffs and longer trouble-free service.

Many station-piping systems will probably be replaced by modern welded systems now that hostilities have ceased. By giving some thought to the arrangement with provision for expansion, the designer can eliminate the headaches that always accompany an inadequate system.

The Possibilities of Pipe-Line Research

(Continued from page 194)

nature. If the employment of a number of returning soldiers can be worked out, it will prove interesting, if not fascinating for the individuals involved. These types of studies and investigations are excellent training for young engineers, and if the student proves his ability, it may lead to advancement in the company. It will also carry the satisfaction of doing something creative, which is so dear to the heart of every engineer.

The over-all results obtainable through providing extra jobs for a number of fighting men should result in new and better methods for the pipe line companies. If this type of program is pushed it should prove highly profitable to the company

and result in lower operating costs. It will be a chance to provide better service to the shipper. After all, the pipe line companies are common carriers and are committed to moving oil for the public interest at the least possible cost consistent with good safe practice. These same companies are entitled to a reasonable return on the investment involved.

The end of the war will allow the pipe line companies to return to normal conditions with all the peacetime possibilities of individual initiative and cooperative effort. The adoption of research and development programs offers employment possibilities for a number of specially trained men which should result in mutual benefit to everyone involved.

BOOKS

CHEMICAL CONSTITUENTS OF PETROLEUM. By A. N. Sachanen, Reinhold Publishing Co., New York, N. Y. 450 pp. $8.50.

The author adds this work to his useful shelf of books, covering a field of ever-growing importance to the petroleum chemist, engineer, researcher, and practical refining operator. At first glance it may appear that the author spent too much space discussing analytical methods. The first 196 pages are devoted entirely to the summary and many details of different methods used by investigators. Since, however, the method employed indicates frequently the degree of accuracy of the results reported and since also the investigator may use this work as a reference for methods as well as compositions, the attention paid to these methods seems not to be overdone.

In addition to studies of compositions of hydrocarbons in various fractions and crudes from all over the world, the work gives considerable attention to oxygen compounds, and those containing sulfur and nitrogen. Resinous and asphaltic materials occupy an entire chapter; the author points out especially the shortcomings of the analytical methods used to determine these constituents and indicates the need for improvement in these methods. Russian, Romanian, Asiatic, and other foreign oils are included in the various tabulations. Data such as those given on the petroleum-acid content of various crudes are of special interest to the chemical student and those interested in special products from petroleum. The volume closes with a discussion of classifications schemes for crudes, in the light of compositions and of the work of the U. S. Bureau of Mines. More than 900 literature references are given in the volume.

Robert Nerem, formerly assistant superintendent of sales department construction engineering for Standard Oil Co. (Indiana), has been promoted to superintendent. He takes the place of **J. A. Parks,** who retired after 28 years' service. His place as assistant superintendent will be filled by transfer of **R. A. Niles** from South Bend, Ind., where he was superintendent of construction.

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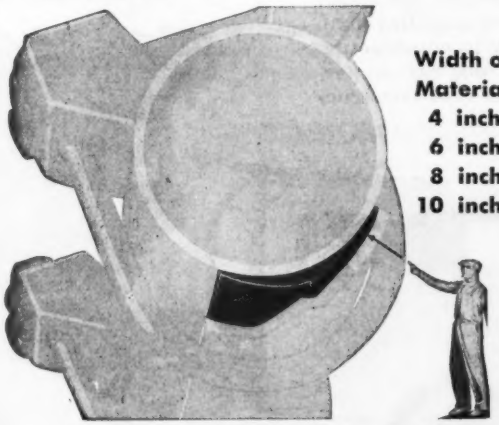

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8 inch	5/16"	3/16"
10 inch	3/8 "	7/32"

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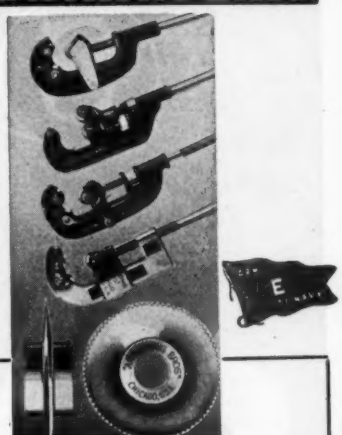

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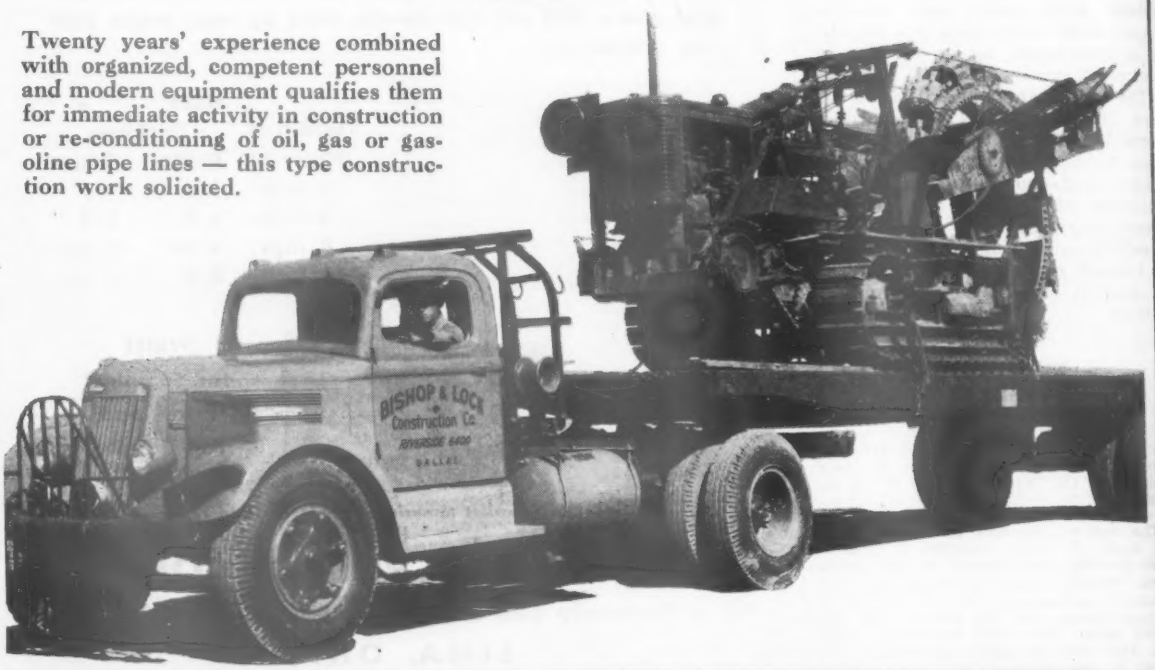

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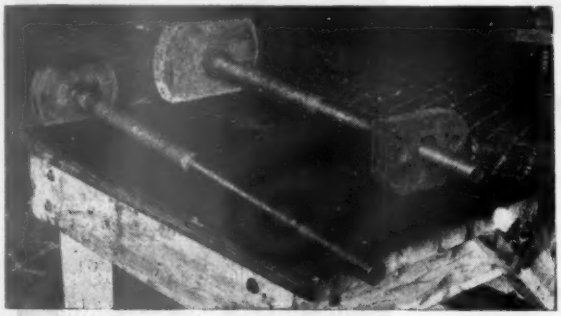
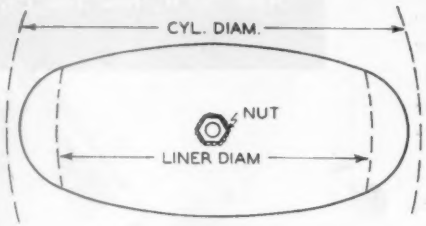
PLANT PRACTICES

Pump-Cylinder-Liner Puller

THE device shown in the illustration has proved very useful in removing stubborn pump liners which must be replaced. It consists of a block of elliptical shape, the short axis of which is less than the diameter of the liner to be pulled; the long axis is longer than the diameter of the liner, but shorter than the diameter of the cylinder when the liner is out. To the center of this block a threaded nut of the required size is welded; a rod, somewhat longer than the pump-cylinder length is threaded on each end, one end a short thread



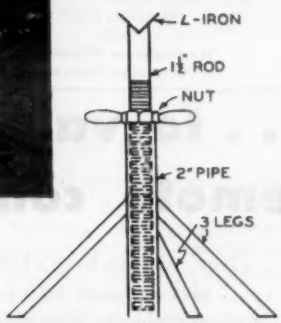


to fit the welded-on nut; the opposite or pulling end is threaded for several inches, as long as may be required by the individual condition, and on this end are placed two or more nuts.

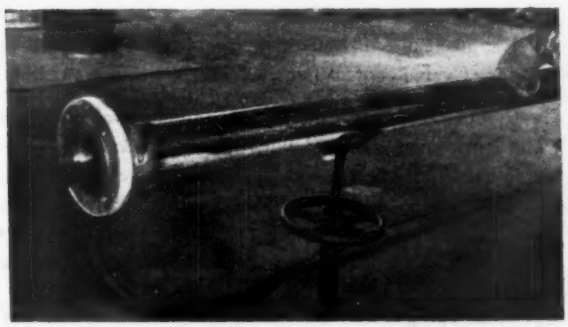
To remove a cylinder liner, the heads are removed and any other items which may interfere with the liner's removal. The block is turned with its long axis parallel to the length of the liner and passed through the cylinder; when beyond the cylinder at the inner end it is turned crosswise with the side having the welded-on nut turned toward the direction of pull, the plane of the block at right angle to the line of the cylinder center. The rod is passed in and screwed into the block in this position. Power of any available sort is attached to the outer end of the rod, and the liner is pulled out forthwith. Any number of different sizes of puller may be made up to fit different sizes of cylinders and liners in the plant, and the idea eliminates trouble caused by the "pulling holes", placed in the liner edges by manufacturers, which soon pull out.

Adjustable Support Facilitates Welding Fabricated Piping

MANY varieties of a single principle may be employed for this unit, one of which is illustrated by the accompanying drawing. The main operating stem is threaded to any desired thread on a, for example, ⅞-in. rod of a length not more than that of the larger base housing tubing. A nut of any desired type, such as "hex" nut with butterfly wings welded on each side, or short bars of steel on opposite sides, runs on this thread, and rests on the top of the main housing base tubing section which is fastened to the base. This



Above and below—Pipe supports in use. Right—Details of construction



base may be a circular disk of sheet steel, ¼ in. or more or less in thickness and of such diameter as may be considered desirable for a steady support. The top of the threaded rod is fitted with a section of angle iron of any desired size, set so that the bisector of its angle is vertical.

A variant of this arrangement is that the threaded rod is fitted into a section of larger-diameter pipe; a set screw passes through the main base pipe section, attached to the base, and thus the intermediate section may be raised or lowered, giving greater flexibility of adjustment to the assembly. A set of typical dimensions for such a support is: Threaded rod, ⅞-in. diameter, 16-in. long angle, 3-in. by 3-in.; intermediate tube 1-in. diameter, 16-in. long; main base tube 1¼-in. diameter, 18 in. long; base plate, 16-in. diameter.

A variant of the base of this support is a pyramidal base of three legs, with reinforcing cross bars in triangular position, the legs being welded to the main base tube at some point, as half-way up its height, and with refinforcing bars extending from the lower section of this base tube to the legs where the horizontal braces are welded on.

The ideas described here are used in the Cleveland and Toledo refineries of Standard Oil Co. of Ohio

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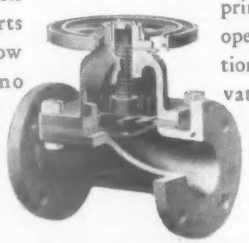

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The MER for Displacement of Oil By Gas at Negligible Pressure

*by Park J. Jones**

THE OPTIMUM RATE OF PRODUCTION

PART 4 OF A SERIES

THE MER for displacement of oil by gas may be variously expressed. But the rate of advancement of gas-oil interface parallel to bedding probably has more applications than any other method. Gravity may displace oil relative to gas provided the downdip rate of gas-oil interface advancement is not too fast. The rate of oil displacement by gravity relative to gas is highest at no free gas saturation. After a gas-oil interface invades a given section of pay, the rate of oil displacement by gravity from that section decreases rapidly. Gravity does not increase oil recovery. It reduces the volume of gas required to achieve a desired oil recovery, provided gas-oil interfaces advance downdip and the rate of advancement is not too fast. Field experiences with displacement of oil by gas under viscous conditions indicate that 200 ft. per year parallel to bedding is about the lower limit of interface advancement for most reservoirs. If gravity is not effective at 200-ft.-per-year rate, it is not likely to be significantly more effective at a slower rate. In reservoirs having a comparatively high permeability or a steep dip, gravity may be effective at rates of interface advancement faster than 200 ft. per year. A procedure for estimating whether gravity is effective at rates faster than 200 ft. per year is included. The MER corresponding to 200 ft. per year is illustrated by examples. The MER varies with the initial position of a gas cap. The MER for displacement of oil by gas may influence optimum rates of production through size of reserve, required investments, or operating expenses.

Displacement of Oil by Gas

CONSIDER downdip displacement of oil by gas. Aside from gravity, the breakthrough oil recovery from a section just invaded by a gas-oil interface is defined[1] by:

$$U = 20 - \frac{0.01\ P\ \mu_L}{TZ\ \mu_G} \qquad (1)$$

where

U = breakthrough oil recovery, per cent of oil initially in place

b = volume factor for reservoir liquid, barrels of space per barrel of oil at saturation pressure

P = reservoir pressure, psia.

T = reservoir temperature, °R.

Z = compressibility factor for gas

$\frac{\mu_L}{\mu_G}$ = ratio of reservoir liquid viscosity to gas viscosity

For example, if the volume factor were 1.3; reservoir pressure, 2,000 psia.; ratio of viscosities, 70; reservoir temperature 140° F., and compressibility factor, 0.9; the breakthrough oil recovery would be about:

$$U = 20 - \frac{0.01\ (1.3)\ (2,000)\ (70)}{600\ (0.9)}$$

$$= 16.6 \text{ per cent}$$

Advancement of Oil by Gravity

The downdip rate of oil advancement parallel to bedding by gravity relative to gas is defined[2] by:

$$Y = 1,000\ \frac{K\Delta S\ (\sin D)}{bfm\ \mu} \qquad (2)$$

where

Y = rate of oil displacement parallel to bedding, feet per year

K = effective permeability to reservoir liquid, darcys

D = dip of pay in degrees

b = volume factor for reservoir liquid, barrels per barrel

f = porosity, fraction

m = fraction of porosity occupied by reservoir liquid

μ = viscosity of reservoir liquid, centipoises

ΔS = specific gravity of reservoir liquid less specific gravity of gas, (sp. gr. water = 1)

For example, if a pay dip were 200 ft. per 1,000 ft.; specific gravity

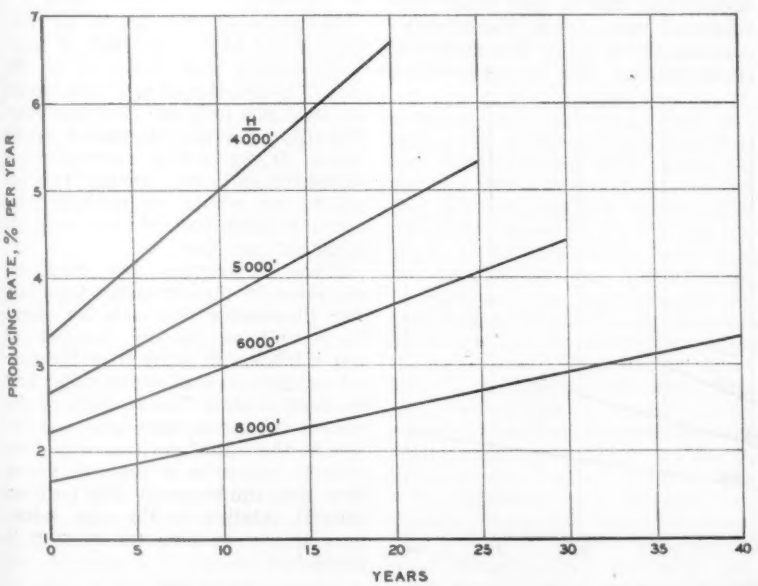


Fig. 4-1—The MER at 200 ft. per year vs. time for displacement of oil by gas in linear reservoirs having a twofold increase of pay thickness; H is the distance from the initial position of gas-oil contact to the structurally low limit of production

*Production consultant, Houston.

of reservoir liquid, 0.6; specific gravity of gas under reservoir conditions, 0.3; volume factor for oil, 1.3; viscosity of reservoir liquid, 1.4 centipoises; effective permeability to reservoir liquid at 20 per cent gas saturation, 1,200 md.; porosity, 25 per cent; fraction of porosity occupied by reservoir liquid, 0.6. In this example:

$$Y = \frac{1{,}000\ (0.3)\ (0.2)}{1.3\ (0.25)\ (0.6)\ (1.4)}$$

$$= 220 \text{ ft. per year}$$

Gas Displacement

The maximum oil recovery by gas and gravity displacement from any section invaded by gas is not likely to exceed the recovery defined[1] by:

$$U_o = 60 - \frac{0.03\ b\ P\ \mu_L}{TZ\ \mu_G} \qquad (3)$$

where U_o is the maximum oil recovery by gas and gravity displacement from any section in per cent of the oil initially in place. The other symbols have the same meaning as those in Equation 1. The maximum oil recovery from any section for the data given in connection with Equation 1 is as follows:

$$U_o = 60 - \frac{0.03\ (1.3)\ (2{,}000)\ (70)}{600\ (0.9)}$$

$$= 49.8 \text{ per cent}$$

In order to realize a recovery from any section on the order of 50 per cent of the oil initially in place, the gas-oil ratio for the production from the section would have to be in excess of 20,000 cu. ft. per barrel of oil.

Two Hundred Feet Per Year

The MER for displacement of oil by gas may be variously expressed. But the rate of advancement of gas-oil interfaces parallel to bedding probably has more applications than any other method. Field experience on displacement of oil by gas under various reservoir conditions indicates that 200 ft. per year parallel to bedding is about the lower limit of interface advancement for most reservoirs. If gravity is not effective at 200 ft. per year, it is not likely to be significantly more effective at a slower rate of interface advancement. On the other hand, gravity may be effective in some reservoirs at rates of interface advancement which are faster than 200 ft. per year. High effective permeability to reservoir liquid, steep dips, and low viscosity tend to increase the rate of oil displacement by gravity. Equation 2 may be used to estimate whether gravity is effective at rates faster than 200 ft. per year. The suggested value for K, the effective permeability to oil, is 50 per cent of permeability. The corresponding value of m is 0.8 (1 — I), where I is the interstitial water saturation. These particular values of K and m are relative to 20 per cent free gas saturation.

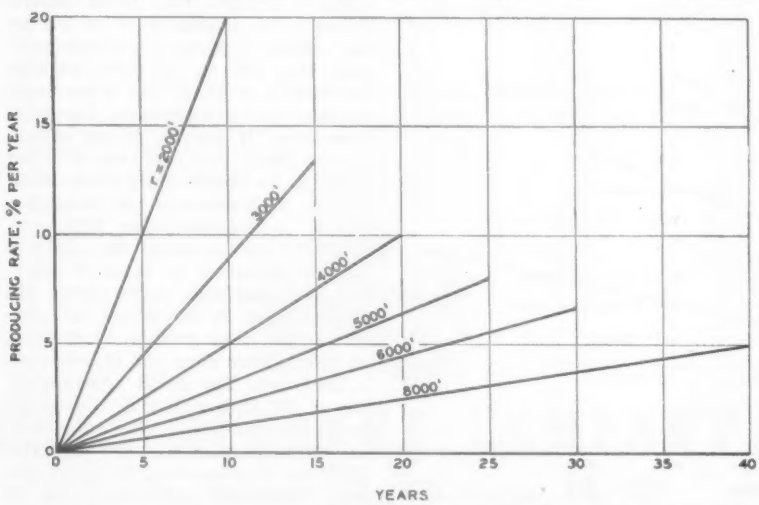


Fig. 4-2—The MER at 200-ft.-per-year vs. time for displacement of oil by gas in radial reservoirs having uniform pay thickness and no primary gas cap; producing rate in per cent per year of initial reserve; r is radius of reservoir

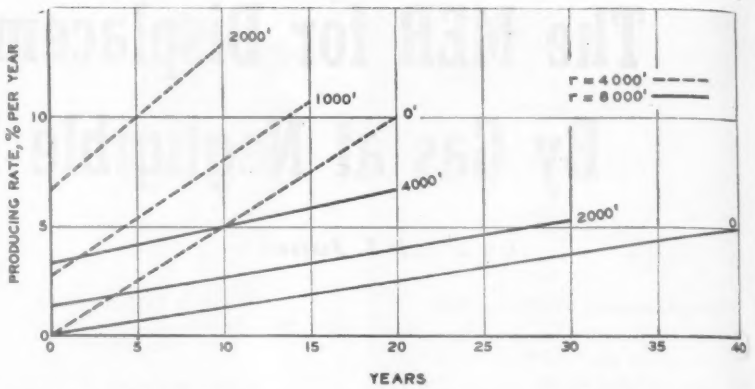


Fig. 4-3—The MER at 200-ft.-per-year vs. time for displacement of oil in radial reservoirs having uniform pay thickness and a primary gas cap; producing rate in per cent per year of initial reserve; r is radius of reservoir; numerals indicate radial distance to the initial position of gas-oil contact

The MER for a Linear Reservoir

Consider a linear reservoir. Let H denote the horizontal distance from the initial position of the gas-oil contact to the structurally low productive limit. Let the dip be negligibly small. Then 200 ft. parallel to bedding is almost equal to 200 ft. in a horizontal plane. Let E denote the rate of oil displacement by gas from a reservoir in barrels per barrel per year of an initial reserve. Then for no sectional convergence, the MER would be defined by:

$$E = \frac{200}{H} \qquad (4)$$

In this case, the rate of production would be independent of time. For example, if H were 4,000 ft., the rate of production at any time would be 200/4,000 or 5 per cent per year. The life of a reserve would be 20 years. If the initial reserve were 40,000,000 bbl., the annual rate of production would be uniform and equal to 2,000,000 bbl. per year or 5,500 bbl. per day.

However, suppose pay thickness increases in the downdip direction. For illustrative purposes, let there be a uniform twofold increase of pay thickness in going from the gas-oil contact to the structurally low productive limit. The position of the gas-oil contact at any time n relative to the initial position would be 200n/H, where n is time in years. The pay thickness at the position 200n/H relative to the pay thickness at the position for n = 0 is given by:

$$h = 1 + \frac{200n}{H} \qquad (5)$$

Upon multiplying the right side

of Equation 4 by that of Equation 5 and dividing by the average pay thickness (1 + 2)/2 or 3/2 we obtain:

$$E = \frac{400}{3H^2}(H + 200n) \qquad (6)$$

Equation 6 includes the areal factor 200/H. There is no areal convergence or divergence in this example. So the areal factor 200/H does not vary with time. The sectional factor 2 (H + 200n)/3H increases with time in this example. More generally, the rate of oil recovery by gas displacement from a linear reservoir, or from that portion of a reservoir which may be linear, is defined by the product of a uniform areal factor and a sectional factor. The sectional factor usually varies with time, that is, oil recovery either increases or decreases per foot of interface advancement.

The lines in Fig. 4-1 are solutions of Equation 6. The rate of production E, in per cent per year of initial reserve, is plotted against time in years. The distances H from the initial position of a gas-oil contact, or source of gas, to the structurally low productive limit range from 4,000 up to 8,000 ft. This example is for a uniform twofold sectional divergence.

An Example on Linear Reservoirs

The initial oil reserve for a linear reservoir is 40,000,000 bbl. Estimate the MER by 4-year intervals if the conditions are as follows: (1) A twofold increase of pay thickness between the initial position of the gas-oil contact and the downdip productive limits, and (2) the distance between the initial position of the gas cap and productive limits is either 4,000 or 8,000 ft. Solutions of this example are given by Equation 6 and may be itemized as follows:

Downdip distance, ft.	4,000	8,000
Years	Bbl. per day	
0	3,600	1,800
4	4,400	2,000
8	5,000	2,200
12	5,900	2,360
16	6,600	2,550
20	7,300	2,740
Remaining life at MER, years	None	20

No Primary Gas Cap

In order to illustrate the MER for radial reservoirs, we first assume uniform pay thickness and no primary gas cap. Let r be the average radial distance to the productive limits. The position of a gas-oil interface at any time n is 200n, where n is time in years. The length of the interface is proportional to 2 (200n). The total reserve is proportional to r^2 and the rate of interface advancement is 200 ft. per year. Hence the MER is defined by:

$$E = \frac{80{,}000n}{r^2} \qquad (7)$$

where E is the rate of oil production at MER in barrels per year per barrel of initial reserve.

The data in Fig. 4-2 are solutions of Equation 7. Rate of production in per cent per year of initial reserve is plotted against the life of a reserve in years. If a radial reservoir has no primary gas cap, the initial rate of production corresponding to 200-ft.-per-year interface advancement is comparatively small. The rate of production increases with time. This increase results from the increase in area per foot of interface advancement in radial reservoirs. The data in Fig. 4-2 are for uniform pay thickness. In practice, the effect of variable pay thickness would be superimposed on the areal divergence of reserve.

Primary Gas Caps

In order to illustrate the MER, at 200-ft.-per-year downdip advancement of gas-oil interfaces, for radial reservoirs having a primary gas cap, we assume uniform pay thickness. Let r_o denote the initial position of a gas contact. Then the position of a gas-oil interface at any time n relative to the initial position is equal to (r_o + 200n). Let r denote the productive limit. Then the area between the initial position of a gas contact and the productive limit is proportional to ($r^2 - r_o^2$). Hence, the rate of production E is defined by:

$$E = \frac{400(r_o + 200n)}{r^2 - r_o^2} \qquad (8)$$

The data in Fig. 4-3 are solutions of Equation 8. Rate of production, in per cent per year of initial reserve, is plotted against the life of a reserve for gas-oil interface advancement at the rate of 200 ft. per year in radial reservoirs having no sectional convergence or divergence. Two sets of lines are shown. The solid lines show the producing capacity of an 8,000-ft. reservoir. The line denoted by zero is relative to no gas cap. The lines denoted by 2,000 and 4,000 ft. are relative to an initial gas contact at 2,000 or 4,000 ft. respectively. The dashed lines are for a 4,000-ft. reservoir. The zero dashed line is relative to no gas cap. The other two dashed lines are relative to a 1,000 or a 2,000-ft. initial gas-oil contact respectively.

The presence of a gas cap increases the initial rate of production from zero per cent per year up to $40{,}000r_o/(r^2 - r_o^2)$ per cent per year of an initial reserve. Other things equal, the presence of a gas cap shortens the life of a reserve from r/200 down to $(r - r_o)/200$. These data are relative to no sectional convergence or divergence.

An Example on Radial Reservoirs

The initial oil reserve for a radial reservoir is 40,000,000 bbl. Estimate the MER by 4-year intervals if the conditions are as follows: (1) Uniform pay thickness, (2) radius of reservoir is 6,000 ft., and (3) the initial position of the gas cap is either at 1,000 or 2,000 ft. Solutions of this example are given by Equation 8 and may be itemized as follows:

Initial position of gas cap, ft.	1,000	2,000
Years	Bbl. per day	
0	1,250	2,700
4	2,250	3,800
8	3,300	4,900
12	4,250	6,300
16	5,250	7,100
20	6,250	8,200
Remaining life at MER, years	5	None

Well-Producing Capacity vs. MER

The above examples on the producing capacity of reservoirs at 200-ft.-per-year gas-oil interface advancement show that reservoir producing capacity may increase with time. The producing capacity of reservoirs by gas displacement may be higher at abandonment than at any other time. This condition does not harmonize with well-producing capacities. The well-producing capacity for a reservoir generally approaches abandonment at declining rates of production. The per-well producing capacity may not decline. But the number of wells at abandonment of a reservoir is usually small compared with the number of wells at any other time prior to abandonment.

Evidently, data of the type shown in the figures of this article do not harmonize with well-producing capacity. But the rate of production from reservoirs cannot exceed the well-producing capacity for reservoirs. As a consequence, the ultimate result may be (1) a loss of reserve, (2) an increase of the life of an invariant reserve, (3) an increase in the cost of recovering an invariant reserve, or (4) some combination of the three possibilities. These conditions influence the present value of an oil reserve to be recovered by gas displacement and, therefore, the optimum rate of oil production by gas displacement. Finally, we might note that oil reserves by water displacement are higher than by gas displacement. The relative size of reserves by gas and water displacement is an additional element.

References

1. The Oil and Gas Journal, Apr. 7, 1945, p. 91.
2. The Oil and Gas Journal, Apr. 21, 1945, p. 124.

PROGRESS IN METALS

by W. L. Nelson
Consulting Engineer

Vital Manganese

MANGANESE is necessary in the manufacture of any high-grade steel or ferrous product and hence it is vital to the oil industry because the industry is a large user of high-quality steel. Obviously, steel is a necessity in modern war and hence the development of local manganese ores is doubly important. The impression has existed for many years that the United States does not have adequate deposits of manganese ores but according to J. Carson Adkerson, president of American Manganese Producers Association, in his statement before the ways and means committee of the House of Representatives regarding the 1945 Extension of Reciprocal Trade Agreements Act, our manganese ore deposits are not inadequate. Much of the following was taken from the Adkerson statement.

Manganese first became strategic mineral No. 1 in 1914 and has always remained at the top of the list of military-emergency procurement problems. Manganese is the "starch" in steel. Without manganese there can be no satisfactory steel product. There is no known substitute for manganese. It stands in a category all its own. Little hope of quickly developing a substitute is held by metallurgists.

The reason for the strategic position of manganese is plain. During the war we consume over 1,300,000 long tons of high-grade manganese ore per year. In prewar years our average consumption was around 800,000 tons. According to the U. S. Bureau of Mines, the domestic production of high-grade manganese ore containing 35 per cent or more manganese in the year 1944 was the largest since 1918 and the second most productive year on record. During 1944 output of high-grade manganese ore as measured by shipments from mines is estimated at 243,000 short tons. Domestic shipments of low-grade ore containing 5 to 35 per cent manganese in 1944 totaled 1,660,000 short tons. Under normal conditions our major sources of supply of high-grade ore are Russia, Africa, India, and Brazil, all more than 4,000 miles away.

The ability of the domestic industry to produce manganese ores is illustrated in Table 1, which was assembled from U. S. Bureau of Mines publications.

The domestic industry produces practically all the low-grade manganese ore needed. Since 1940, with the war in Europe and the beginning of our own stockpiling program, producers in the United States have supplied the war effort 757,432 tons of high-grade manganese ore (35 per cent and above Mn) and around 2,000,000 tons of low-grade ore (10 to 35 per cent Mn). This ore was produced at a time when the situation was seriously uncertain. This was done during the war years when the top officials in the war agencies were saying that they were getting not only every ton but every pound of manganese ore available in the world.

It is often said that domestic manganese ores are low grade. During World War I domestic shipments of high-grade ore contained 40 per cent manganese. Today, under the stimulation of war demand, United States miners are producing from one plant alone, more than 100,000 tons a year of manganese ore running as high as 60 per cent metallic manganese, which is higher grade than any ore from any foreign country. This is produced from low-grade ore, which, as mined, runs from 15 to 25 per cent manganese, formerly unknown and considered worthless. Some of it is mined at a depth of 2,000 ft. below the surface. Additional milling-plant facilities have been installed since the start of the war, but such deep-mine developments would never be undertaken after the start of a war. They must be carried forward over a long period of years during peacetime.

It is often stated that we have become a "have-not" nation, that we need to conserve our minerals. This is not true in the case of manganese. We have an abundance of low-grade manganese ore which is now being mined and concentrated into a product higher in grade than foreign ores. Our total known reserves of low-grade manganese ore in 25 states exceed 200,000,000 tons and further work discloses additional reserves. It simply takes time for development of underground ore bodies.

TABLE 1—DOMESTIC SHIPMENTS OF MANGANESE ORE, IMPORTS OF MANGANESE AND FERROMANGANESE, AND APPARENT CONSUMPTION OF MANGANESE METAL, 1910-1944 (IN LONG TONS)

	Manganese ore				
	Domestic shipments				
Year—	10 to 35 per cent Mn	35 per cent or more Mn	Imports	Imports of ferromanganese (gross weight)	Apparent consumption of manganese metal
1913	9,650	4,048	345,090	128,070	217,658
1914	60,484	2,635	283,294	82,997	162,112
1915	64,204	9,558	320,778	55,263	179,266
1916	316,600	31,474	576,321	90,928	283,944
1917	576,608	129,351	629,972	41,969	271,770
1918	818,003	305,869	491,303	27,168	297,303
1936	98,962	32,119	813,362	37,953	310,497
1937	151,955	40,241	911,922	29,559	.....
1938	33,620	25,321	483,588	26,258	217,961
1939	239,544	29,307	627,131	41,227	273,570
1940	320,006	40,123	1,282,079	10,369	397,587
1941	457,287	78,388	1,530,876	6,278	443,626
1942*	268,764	190,748	(†)	(†)	(†)
1943*	471,593	205,173	(†)	(†)	(†)

*Short tons. †Figures not available for publication.

Corrosion Resistant Wiring

Callite Tungsten Corp. (Union City, N. J.) under the trade name "Kulgrid" is producing a combination copper-nickel electrical conductor wire. The copper core of the wire contributes electrical and thermal conductivity (70 per cent of that of pure copper), the nickel cover provides resistance to corrosion at high temperatures, and the combination cold-drawn wire has a strength four times that of copper.

Metallurgical Terms

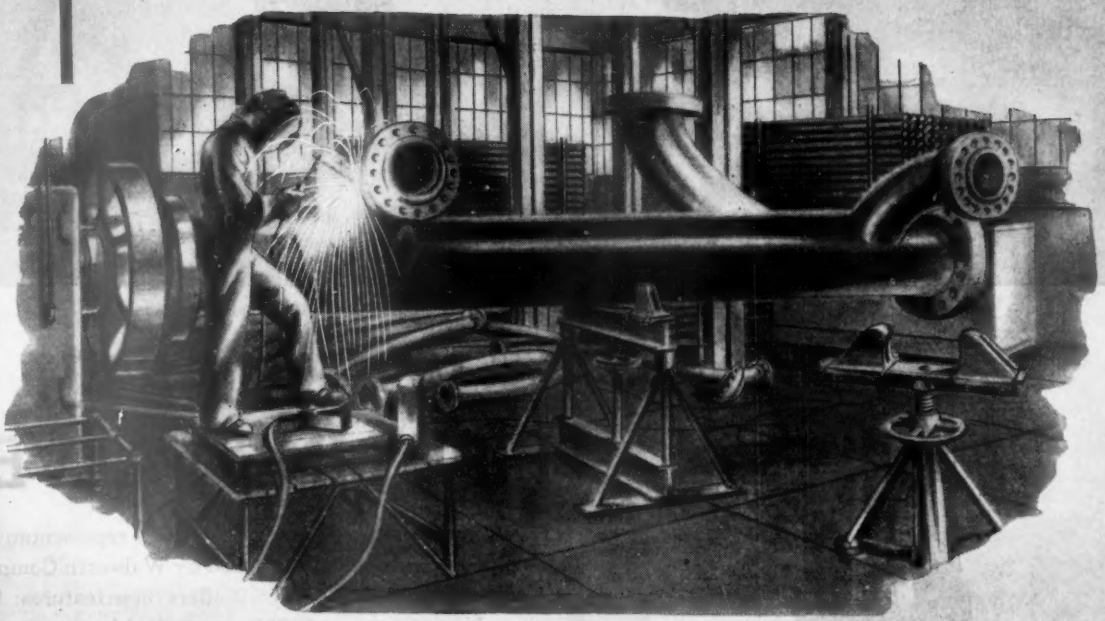
Blast Furnace

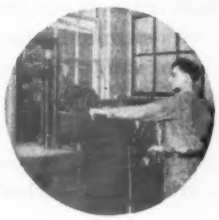
A blast furnace is a vertical-shaft-type furnace used for reducing ore to pig iron. The furnace is charged at the top and an air blast enters at the bottom. Probably more than 90 per cent of all ferrous alloys (steels, irons, malleable iron, etc.) are made from pig iron produced by blast furnaces.

Box Annealing

The operation of annealing steel by heating it in a closed metal box which protects it from oxidation is called box annealing. It is one method of conducting the more general type of annealing referred to as bright annealing.

• SHOP WELDING of Pressure Piping has Important Advantages





Welding of pressure piping in the shop of a qualified pipe fabricator has many advantages which are difficult to duplicate in the field.

The great volume of pressure welding done in the plant of the fabricator gives *continuous* employment to large numbers of qualified welders—this day-after-day welding means that the hand never loses its skill. The welders are provided with a wide variety of work rotating fixtures for position welding under the most favorable conditions for both quality and production. Other facilities (usually superior in the shop) that have a direct bearing on the quality of welded piping include equipment for accurate layout, correcting alignment, stress relieving, cleaning and testing.

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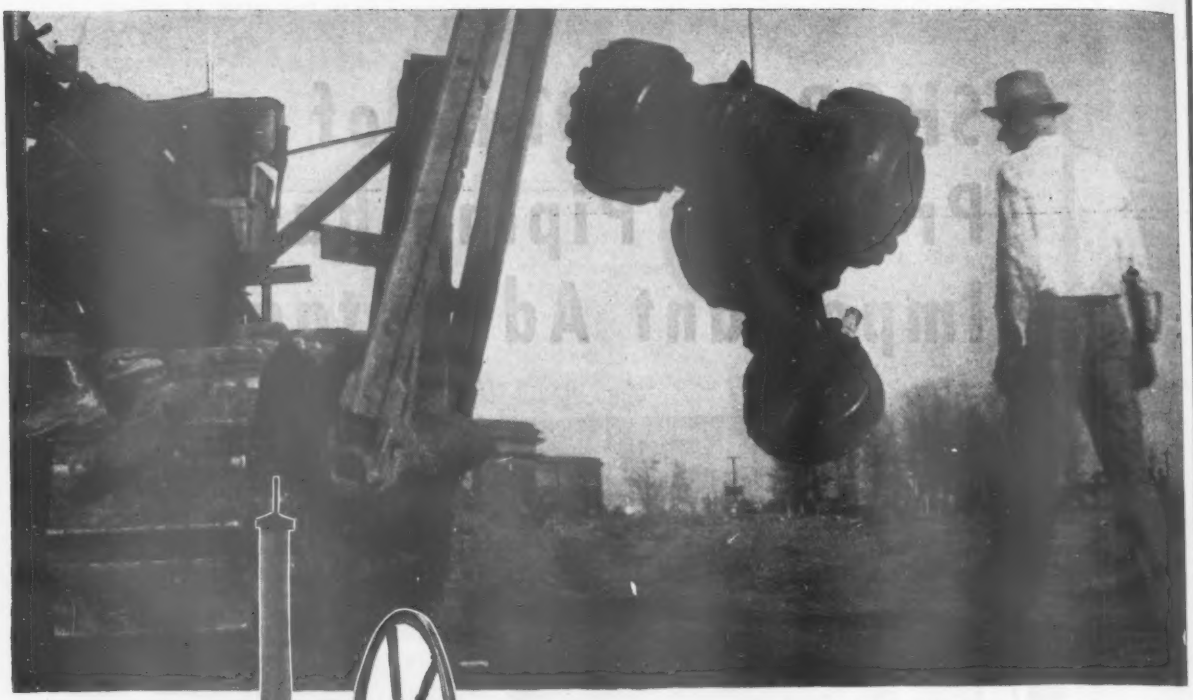

UNRETOUCHED PHOTOGRAPH OF AN ACTUAL INSTALLATION

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The 16-inch cast steel valve illustrated is representative of the pipe line valves manufactured by Walworth Company. Designed for pipe line service, it offers these features: 1000 psi working pressure — 1800 psi test; double discs, parallel seats; outside screw and yoke bonnet construction; ball bearing bevel gear operation; stellited seats and discs; stem and bevel gear dust protector with stem indicator; flanges faced and drilled. These valves meet all requirements of A.P.I. Standard 5-G-1 on Pipe Line Valves.

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Journalog

A FEATURE OF THE OIL AND GAS JOURNAL

No. 71

Discovery Well, Pre-Permian Horizons, Monument Area, Lea County, New Mexico

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Section 23-19-38

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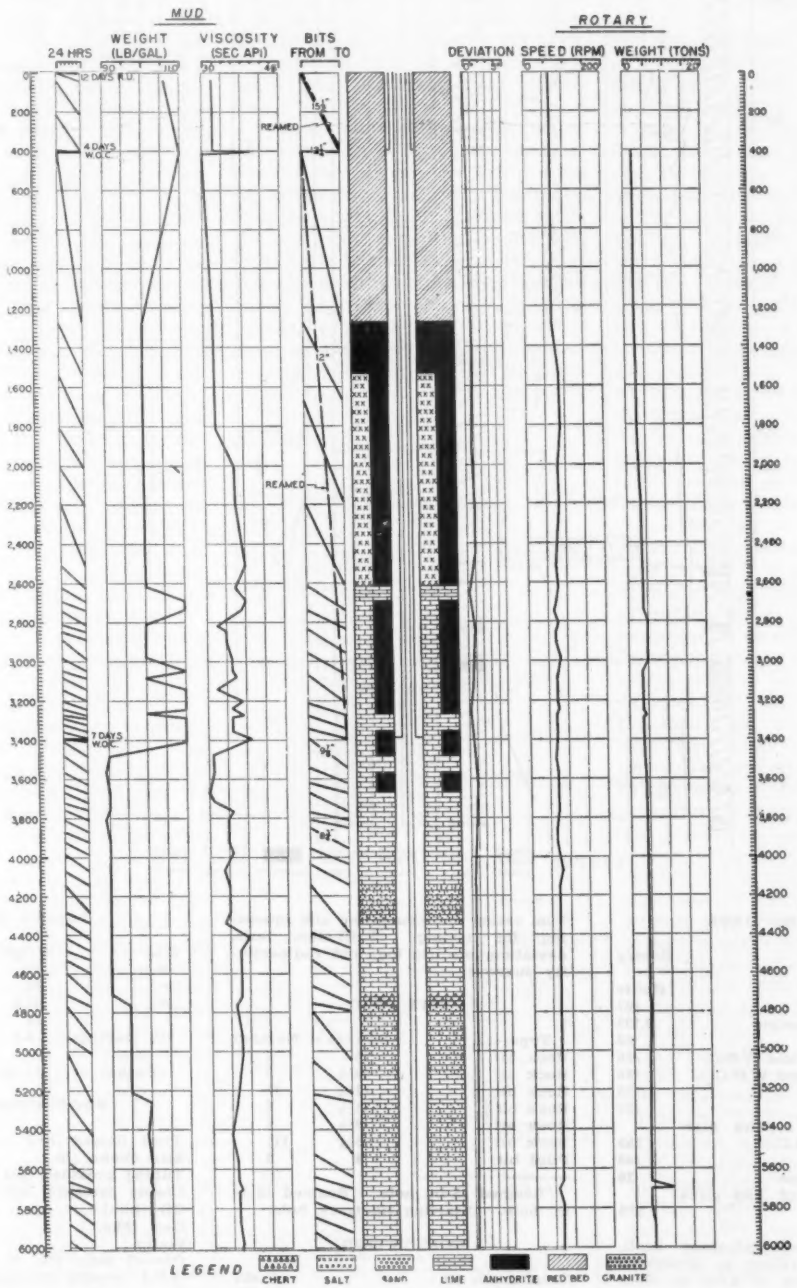

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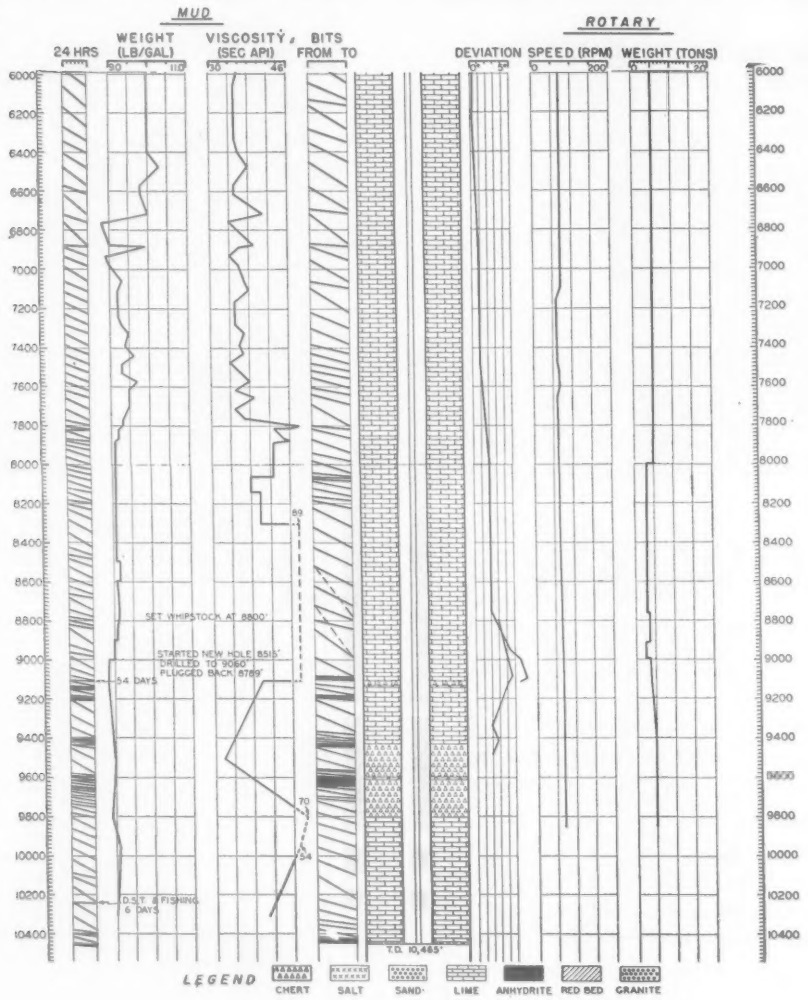
Journalog

Discovery Well, Pre-Permian Horizons, Monument Area, Lea County (Continued)



DRILLING DATA

Type rig	Rotary
Time record:*	**Hours**
Rigging up	167
Drilling and reaming	3,735
Coring	89
Running casing and W.O.C.†	286
Plugging back and W.O.C.	156
Trips	1,270
Fishing	220
Shut down for repairs, materials and W.O.C.	555
Services‡	143
Laying down pipe	26
Conditioning mud and circulating	275

*Includes 54 days plugging back, reaming, and redrilling to straighten hole at total depth of 9,090 ft. Hole reamed and redrilled 8,600-9,090 ft. Two whipstock settings for sidetracking. †Exclusive of cement time for 7-in. casing and cementing and squeezing for testing. ‡Drill-stem tests, deviation, electric log, and radioactivity surveys.

BITS USED

Type—	Size (in.)	Number
Rock bit	15	1
Rock bit	*13½	1
Rock bit	12¼	11
Rock bit	†13¾	6
Rock bit	9⅞	6
Rock bit	8¾	111
Pilot bit‡	6	2

*Reamed 15-in. hole. †Reamed 12¼-in. hole. ‡Starting sidetrack hole.

COMPLETION

Total depth (ft.)	10,465
Plug-back depth (ft.)	7,725
Casing perforations (ft.)	7,700-7,725
Number perforations	75

CASING RECORD

Size (in.)	Weight (lb.)	Depth (ft.)	Cement (sacks)
16	70	396	400
10¾	40.5	3,394	700
7	26	10,465	400
2½ (tubing)	6.5	*7,700	

*Packer at 7,651 ft.

PRODUCTION TEST

Time flowed (hr.)	24
Size choke (in.)	¾
Tubing pressure (psi.)	175
Casing pressure (psi.)	15
Oil (bbl.)	269
Gas (M.c.f.)	150
Water	0
Gas-oil ratio (cu. ft./bbl.)	180
A.P.I. gravity oil (deg.)	42.3
Bottom-hole pressure (psi. at 7,540 ft.)	3,113
Bottom-hole temperature (°F.)	115

The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Bringing a Tower on Stream

WATER is present in a tower that has been offstream because of the steam used to clear it of oil vapor. During first recirculation the water accumulates in the bottom of the tower, strippers and other low points and all of these points should be drained frequently during the early part of the circulation so that as much water as possible is eliminated. Later as the equipment becomes hot, steam begins to appear overhead. At this stage the bottom of the tower should be checked to see that it is not running cold. A cold bottom indicates an accumulation of water which will probably get stirred up later resulting in a tower explosion which may only blow the caps from the trays or wreck the trays but which can also result in a dangerous explosion. Finally, the top becomes dry, water no longer accumulates in the lines to the strippers, and adjustment of tower conditions can commence. Operations that follow are marked by the same numbers on Fig. 1.

1. Operate at a pipe-still outlet temperature that is thought to be higher than that required to vaporize the desired products.

2. The top temperature is adjusted to give the desired end point or 90 per cent point. Notebook No. 48 (June 30) shows that the top temperature of a topping tower is about the same as the 50 per cent distillation of the top product. The top temperature is also equal to the 100 per cent point on the flash curve of the overhead product corrected for the tower pressure and the presence of inert gas or steam.

3. Begin opening the kerosene draw valve. The wider the valve is opened the higher will be the end point of the kerosene. Notebook No. 48 indicates draw-plate temperatures of 320° to 420°, but in most plants it is necessary to await laboratory tests because thermocouples are not available at the draw plates. The initial boiling point and flash point are regulated by the amount of steam used in the stripper. If flash cannot be attained with reasonable amounts of steam it will be necessary to raise the end point of the gasoline, or to produce a naphtha product. Poor separation as indicated by too high an end point on the kerosene can be helped by moving down a few trays.

4. One by one adjust each of the other side-draw products working downward through the tower. The adjustment consists of gradually opening the side-draw valve until the end point is as high as desired. Usually it is necessary to readjust the upper draw-plate settings because the composition of each product is altered by the compositions of the other products, and it is usually necessary to sacrifice either yield or quality in one product in order that the other products will be satisfactory. An example is the overlapping of kerosene and distillate. If the maximum amount of salable kerosene is made, its end point will be so high that the distillate will be deficient in low-boiling constituents and it is therefore common practice to produce distillate at only a few trays lower than kerosene so that the two products will not be well separated. It is also common practice to produce a lower end-point kerosene than would otherwise be necessary. Thus, it will probably be necessary when adjusting the distillate draw plate to go back to the kerosene draw plate and close the kerosene valve slightly so that less kerosene and one of a lower end point is produced.

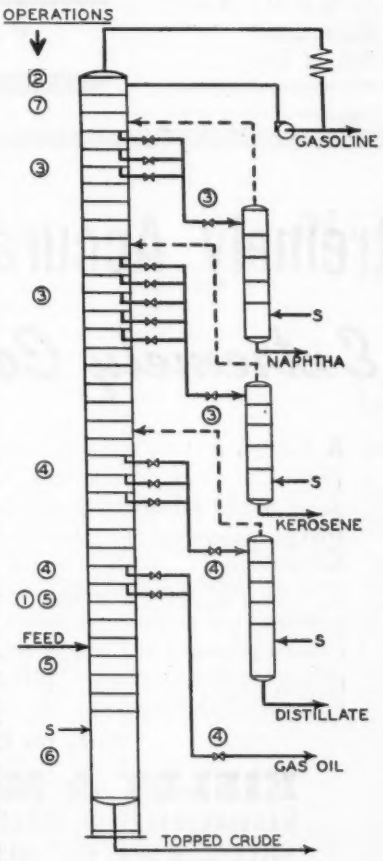


Fig. 1

5. After all of the side-draw valves have been adjusted, it is wise to see if a sufficient amount of material is being vaporized. The pipe-still outlet (and vaporizer) temperature should be high enough to vaporize 3 to 10 per cent more material than is being produced overhead so that the excess vaporization can flow back into the vaporizer (and bottom) washing any black entrained material out of the tower. Proof that excess vaporization is taking place is to open the lowest (usually gas-oil) draw valve little by little until the stream turns dark. Several hours are usually required before the stream goes "off-color." After the lowest product has gone dark, the draw valve can be closed a little (3 to 10 per cent worth of product) or the pipe-still outlet temperature can be raised.

6. The flash point of the topped crude oil is sometimes important and this can be cured by the use of steam. The steam requirement is usually large.

7. Finally, the withdrawal of products from the side of the tower may have so altered the reflux ratio at the top, that it is necessary to readjust the top temperature or in extreme cases to repeat the adjustment of the entire tower.

No. 60 in α series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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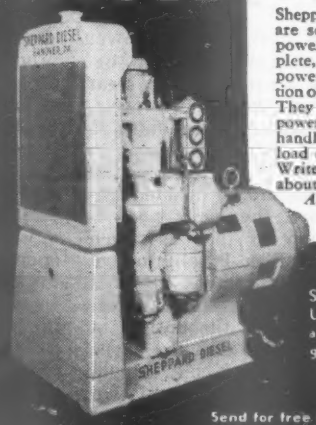

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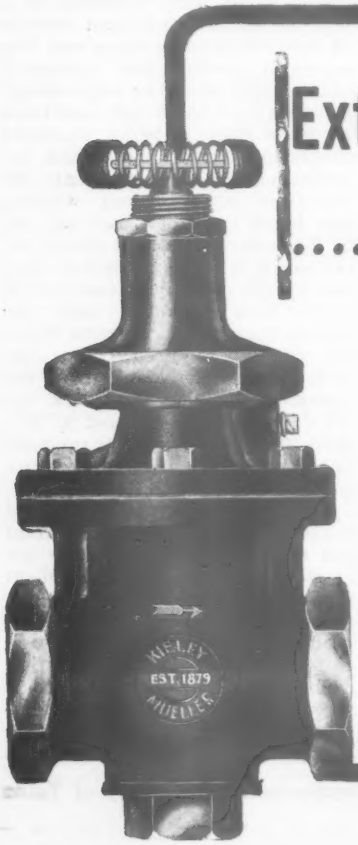

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Natural Gas

Manly Resigns From FPC To Head Atlantic Utility

WASHINGTON.—Basil Manly, chairman of Federal Power Commission, has resigned from that body in order to accept the presidency of Atlanta Gas Light Co. Manly, who was appointed to FPC in 1933, served as director of the commission on industrial relations in 1914-15 and was joint chairman, with former President William H. Taft, of National War Labor Board in the latter part of World War 1.

In his letter of resignation to the president, Manly said: "It is now nearly 40 years since I first became an employe of the U. S. Government. Although nearly half of the intervening period has been spent in private employment, I have devoted the best and some of the most strenuous years of my life to the federal service and have the satisfaction of believing that something worth while has been accomplished for the general welfare."

In accepting Manly's resignation, the president wrote: "Yours has been a long service in the federal Government, and much of it has come during the important events of the last decade. I wish to tender you my personal thanks, as well as those of the nation, for your long record of successful, efficient, and patriotic service."

Beckjord Named President Of Cincinnati G. & E.

NEW YORK.—Walter C. Beckjord, president of Columbia Engineering Corp. and vice president and director of Columbia Gas & Electric Corp. has been elected president of Cincinnati Gas & Electric Co. He succeeds H. C. Blackwell, who asked for retirement in accordance with the company's plan. Blackwell remains actively with the company, having been elected chairman of the board following acceptance of his resignation as president.

Beckjord, who served as president of American Gas Association in 1940, has been identified with the utilities industry since 1909. He graduated from University of Minnesota as an electrical engineer, joined St. Paul Gas Light Co. and later became vice president and general manager. In 1930 he was made vice president and general manager of Boston Consolidated Gas Co., leaving there in 1934 to join Columbia as vice president and general manager.

FPC Finishes Investigation Of Feazel Gas Contract

WASHINGTON. — Federal Power Commission has concluded its investigation, begun December 21, 1943, into the terms of a contract under which W. C. Feazel and associates purchased natural gas produced in the Rodessa field, Caddo Parish, Louisiana, from East Texas Refining Co. of Delaware at 2 cents per 1,000 cu. ft. and sold it to United Gas Public Service Co., predecessor of United Gas Pipe Line Co., at 4 cents. J. Floyd Hodge, Thomas J. Hill, and Richard W. Leche, associated with Feazel, invested no capital in this and two subsequent ventures and incurred no expense, but they received a total of $844,251.

The Rodessa field was largely depleted at the time of the hearing held at Monroe, La., in 1944, and deliveries of gas under the first Rodessa contracts were practically at an end. Deliveries under a second contract had been terminated, and the records show no deliveries under a third contract subsequent to 1943. Further action with reference to the rates and charges under these contracts would serve no useful purpose since substantially all gas availabe for sale under them has been sold and the profits distributed, the commission points out in terminating the proceedings.

California Has No Need of Texas Gas, Says Watson

LOS ANGELES.—"California has reserves of natural gas to supply the needs of the state for over 25 years," said C. P. Watson, president of Oil Producers Agency of California, discussing the proposed gas pipe line from West Texas and New Mexico.

"There is no need for dumping of an outside supply into California," Watson continued. "California is a separate gas province, and its known reserves now approximate 14 trillion cubic feet. The cost of such a pipe line, over 1,000 miles across the desert, would have to be borne by the ultimate consumer. The dumping of outside natural gas into California would inevitably stifle future exploration for natural gas in California. This fact, in conjunction with the growing resistance in Mid-Continent states to the draining off of their highest form of energy resource, can be a source of apprehension to California consumers of natural gas.

"Texas and other Mid-Continent states are planning great postwar industrial expansion, and those states do not propose to wake up and find too much of their natural gas committed to sale in other states. A sudden stoppage in supply from such states would find California's exploration program dwarfed, with a shortage in supply, and ultimate harm to the consumers.

"Moreover, California is the only state in the Union that has no interstate commerce in gas, and hence to date is not subject to the mandates of the Federal Power Commission."

Suit Referred to Master in Chancery for Restudy

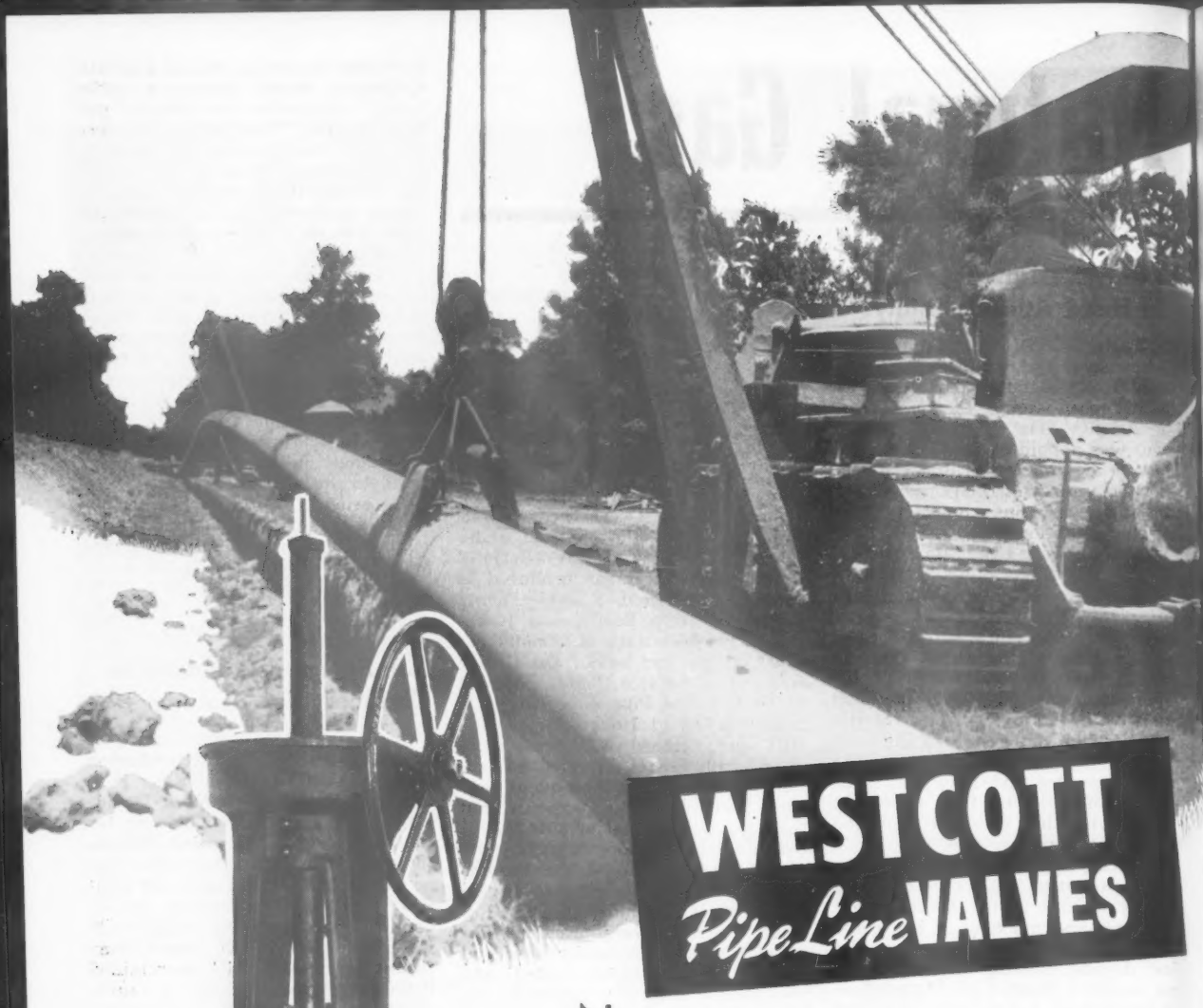
DALLAS.—A natural-gas suit, involving $238,000, from Hutchinson County, has been referred by Federal District Judge T. Whit Davidson to the master in chancery for further study. J. I. Barnhill, Hutchinson County landowner, filed the action against Dave Rubin and Phillips Petroleum Co. asking an accounting of natural gas taken from wells on land which they leased from him, but on which he retained one-eighth royalty rights. A multiplicity of exceptions to the master's findings were taken by both plaintiff and defendants.

Cycling

Construction Started on Carthage Cycling Plant

MARSHALL, Tex. — Lone Star Producing Co. and Rogers Lacy have started construction of a cycling plant in the Carthage field, Panola County, and Lone Star is making preparations to lay 12-in. pipe for a 95-mile gas line from the company's plant at Trinidad, Henderson County, to the Panola plant.

The cycling plant, with a daily capacity of 50,000,000 cu. ft. of gas, will be located 9 miles north of Carthage and a mile south of the Sabine. River, on the Carthage-Marshall highway. Location is being cleared. Lacy several months ago acquired a 50-acre tract as the plant site.



WESTCOTT *Pipe Line* VALVES

NOTHING can be left to chance in the control of today's pipe lines. Nothing is left to chance in the manufacture of Westcott Pipe Line Valves.

Westcott valves are precision built for the oil and gas industries exclusively. They are designed with the assistance of men who know best what a valve must be to give proper, dependable operation . . . the pipe line operators themselves.

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PIPE LINES

Great Lakes Awards Contracts for Line

For the $6,000,000 project for 8-in. pipe line construction at locations between Barnsdall, Okla., and Sioux Falls, S. D., Great Lakes Pipe Line Co. let contracts last week as follows for the southern sections: O. R. Dempsey Construction Co., Barnsdall to Independence, Kans.; Oklahoma Contracting Co., Independence to Paola, Kans.; Midwestern Constructors, Paola to Kansas City, Mo.

Contractors on the northern section are: Williams Brothers Corp. 58 miles north from Omaha, Neb., to the Missouri River; Midwestern Constructors, 58 miles north from the Missouri River; C. W. Sternberg 58 miles south from Sioux Falls, S. D.

Gulf Contracts for West Texas Loops

Gulf Refining Co. awarded contracts last week for laying of pipe for its $8,000,000 project for looping its main line from West Texas to Port Arthur, Tex., in order to increase throughput by 40,000 bbl. daily from present capacity between 60,000 and 70,000 bbl. to 108,000 bbl. daily.

Contracts for laying pipe have been let as follows: Oklahoma Contracting Co., 123 miles of 8-in. and 10-in. at the west end; J. R. Horrigan Construction Co., 120 miles of 10-in. and 12-in. in the middle section; Associated Contractors & Engineers, two spreads to lay a total of 230 miles of 8-in. and 10-in. pipe at the eastern end. The 463 miles of line will be laid in 12 loops.

PIPE LINES

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CONSULTING ENGINEER

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In connection with the program 12 pumping units will be installed at stations each of which will consist of an 860-hp. diesel engine direct-connected by step-up gears to a Cameron centrifugal pump. The project has been planned so that there will be no relay tanks used between Midland and Port Arthur. Approximately 60 miles of pipe for the undertaking is now in transit from the mills.

RFC Orders Five Lines Suspended

Reconstruction Finance Corp. has announced that operation of five government-owned pipe lines will be discontinued within the next 30 or 60 days.

Sam H. Husbands, member of the RFC board, had announced previously the projected end of Government operation of the "Big Inch" and the "Little Big Inch," two of the five lines.

A sixth line owned by the RFC, the Ohio Emergency Pipe Line (8-in.), from Fostoria to Akron, a distance of 82 miles, is being operated under a lease agreement by a private company. The five other lines will be sold or leased to commercial interests by the surplus property board.

The five lines are:

Big Inch—A 24-in. line from Longview, Tex., to the New York harbor area, a distance of 1,254 miles.

Little Big Inch—A 20-in. line from Beaumont to New York, 1,405 miles.

The Florida Emergency Pipe Line—An 8-in. line from Carabelle to Jacksonville, 200 miles.

The Greensboro-Richmond Extension of the Plantation Pipe Line—175 miles of 8-in. line from Greensboro, N. C., to Richmond, Va.

The Southwest Emergency Pipe Line—A 14 and 16-in. line from Corpus Christi to Houston, 154 miles.

RFC invites negotiations for these pipe lines, either on a purchase or lease basis. All inquiries should be directed to the Washington office of the corporation.

Purchases of west and southwest Texas crudes have ceased. As soon as the crude in feeder lines and storage tanks, plus the crude which will be purchased during September, are transported through the "Big Inch," the remaining crude in the line will be delivered to the eastern seaboard

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and the line will be treated with inhibitor to preserve it.

Likewise the "Little Big Inch" will meet only September delivery schedules along the Eastern Seaboard carrying 100-octane aviation gasoline, naphtha, motor gasoline, kerosene, heating oil and diesel oil.

For the week ended August 29, Southwest Emergency Line pumped from Heard station an average of 44,485 bbl. of crude oil.

During the last 5 days in August pumpings through the WEP 24-in. line from Longview to Norris City, Ill., averaged 322,359 bbl.; pumpings from Norris City to the East Coast averaged 324,642 bbl. daily with 168,608 bbl. delivered at Philadelphia and 146,094 bbl. at the New York area. At the same time the WEP 20-in. pumped 113,935 bbl. from Beaumont, Tex., to Linden, N. J.

Iraq Lays Tracks to Prepare for Project

Iraq Petroleum Co. is conducting preliminary field work for a single track railroad from Kirkuk to facilitate its pipe-line project. The line to be laid will consist of 580 miles of 16-in. from Kirkuk, 170 miles north of Bagdad, to Haifa, a Mediterranean port.

Northwestern Plans Alberta Lines

EDMONTON, Alta.—Northwestern Utilities, Ltd., of Edmonton is making surveys for a transmission line to carry natural gas from the Viking-Kinsella field in east-central Alberta to Camrose, Wetaskiwin, Ponoka, Lacombe and Red Deer. Voting on the franchise agreements will take place this month, and it is planned to deliver gas by the fall of 1946.

Texas-New Mexico to Expand Pecos System

Survey is being made by the Texas-New Mexico Pipeline Co. for the laying of 34 miles of 6-in. line to the Fort Stockton pool of west-central Pecos County, Texas, which produces from the Yates formation. This line will be laid from the Abell pool pump station in the northern part of the county.

Cities Service Lays Line in Panhandle

Cities Service Oil Co. is reported to be starting 11 miles of gathering line in Moore and Sherman counties, near Dumas, Tex. Contract for the work has been let to Bishop & Lock Construction Co.

Conviction in Contraband Case

U. S. District Judge Charles A. Boynton fined three officers of the Noelke Pipe Line Co. and the company a total of $10,000, after they had pleaded guilty to charges of shipping contraband oil in interstate commerce.

The three are: Clyde J. Bohner, president; George T. Kimbel, vice president, and Glenn H. Bear, secretary-treasurer. The charges alleged the oil was shipped from Pecos County, Texas, to Boston, Chapo, Chihuahua, Mexico, and other points.

Bell-Western Reconditions North Texas Pipe Line

Bell-Western Corp., affiliated with Bell Oil & Gas Co. interests, has awarded a contract to United Contracting Co. for reconditioning the 4½-in. line running from the Fargo and Odell fields of Wilbarger County, Texas, east across the Red River and through Tillman County, Oklahoma, to the Bell Oil & Gas Co. refinery at Grandfield.

The line will be completely raised, cleaned, coated, wrapped and equipped with cathodic protection and insulating flanges.

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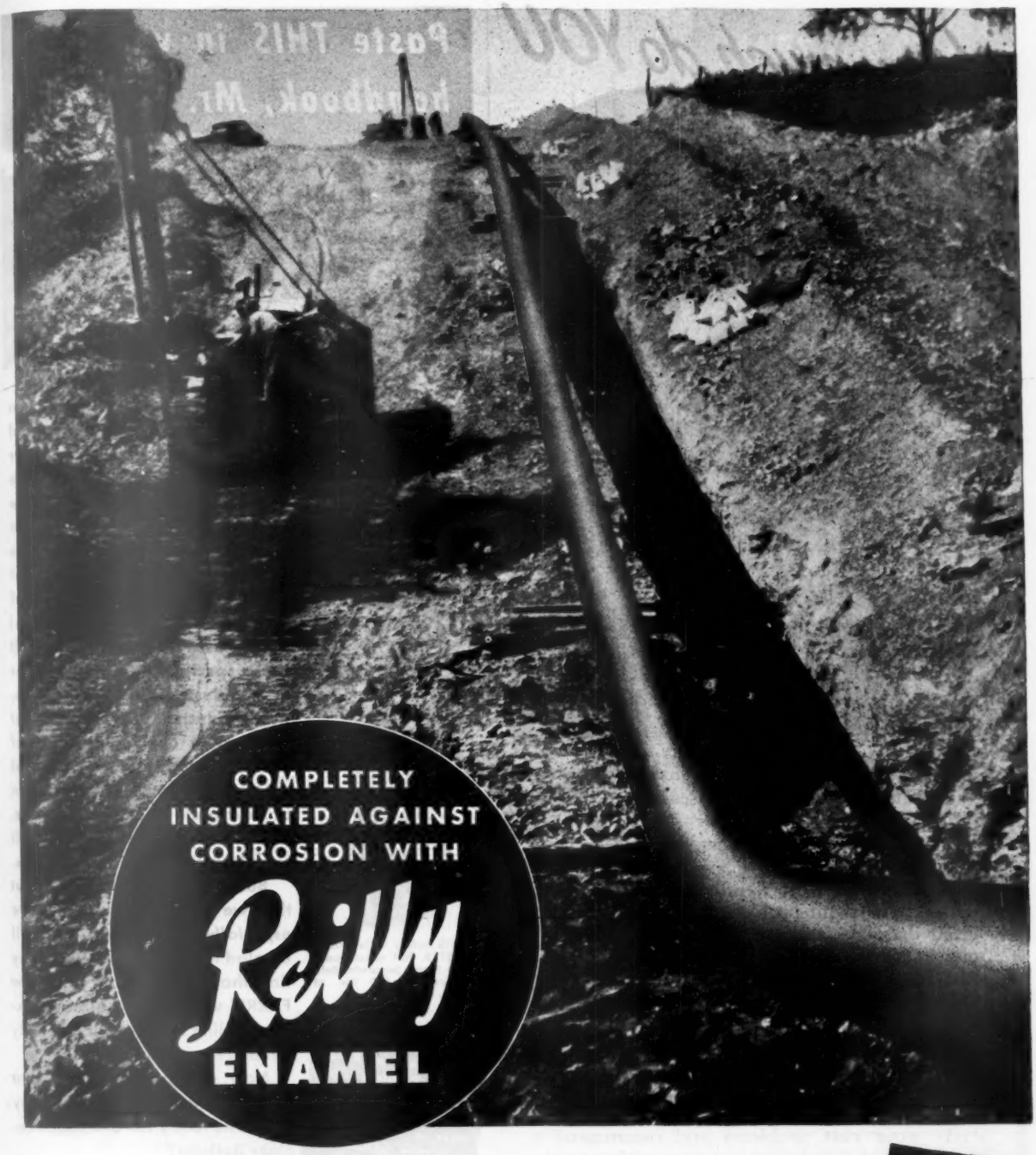

● Reilly Primer and Enamel provide a pipe coating that completely insulates the pipe against destructive elements—preventing all corrosive agencies from coming in contact with the metal. The coating is so regulated in its properties that it will withstand temperatures as low as minus 20°F without cracking or checking, and as high as 160°F without flow or sag. Reilly Enamel is manufactured in two standard grades—also to meet special requirements. It is readily applied—at the mill or in the field—by any of the standard methods.

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Asphalt Subsidiary Formed By Standard of California

SAN FRANCISCO.— Organization of California Asphalt Corp. as a wholly owned subsidiary is announced by Standard Oil Co. of California. The new company will soon begin construction at Willbridge, Ore., of the first asphalt refinery in the Pacific Northwest, costing approximately $1,000,000.

Oil-Refining Industry's Assets at Top in 1943

WASHINGTON.—Figures released by the Treasury Department reveal that of 36 industrial groups covered, oil-refining reported the largest total assets in 1943. That industry's assets rose from $7,874,471,000 in 1939 to $7,956,612,000 in 1940, $8,371,264,000 in 1941, $9,174,897,000 in 1942 and $9,782,563,000 in 1943. They showed an increase in net working capital from $1,644,284,000 in 1939 to $1,652,218,000 in 1940, $1,720,420,000 in 1941, $1,959,595,000 in 1942 and $2,091,658,000 in 1943.

Gulf Coast Gasoline Stocks Register Modest Upturn

HOUSTON.—Stocks of all gasolines and naphthas registered a modest upturn during the second half of August at plants in Gulf Coast Refiners Association, totaling 1,614,560 bbl., up 227,826. Automotive gasoline stocks were 567,179 bbl., up 197,922. Total inventories of all products were 3,042,483 bbl., an increase of 339,483. A year ago the total was 3,604,990. Crude runs totaled 119,699 bbl. daily.

Organic Sulfur Chemicals Available

A family of eight mercaptans, ranging from tertiary butyl mercaptan, t-C_4H_9-S-H, to tertiary hexadecyl mercaptan, t-$C_{16}H_{33}$-S-H, has been made available to the petroleum and chemical industries, according to announcement by chemical products division of Phillips Petroleum Co. Two of these products, t-butyl and t-dodecyl mercaptans are obtainable in tank-car lots, it is stated, in purities of 97 per cent. Two disulfides, di-t-butyl, C_8, and di-t-hexyl, C_{12}, are also available from the same source, the di-butyl product also being available in tank-car lots. The other members are to be had only in lots sufficient for experimental purposes.

Toluene Now Available for Peacetime Commerce

CHICAGO. — Removal by War Production Board of its wartime restrictions on toluene sales releases for peacetime commerce a far greater volume of this product than was available before the war, owing to revolutionary progress in manufacturing methods.

The petroleum industry was responsible for advances through synthesis and recovery from crude oil, thus increasing tenfold the availability of the product, which formerly was made exclusively from coal.

Shell Union Oil Co., Inc., which pioneered in development of methods for making toluene from petroleum and which is itself a major producer of the chemical, has announced that facilities of its large volume plant at Wood River, Ill., are now filling civilian orders.

During the war toluene was the base for TNT, used in making explosives. It is expected the greatest peacetime demand will come from the paint and lacquer industry.

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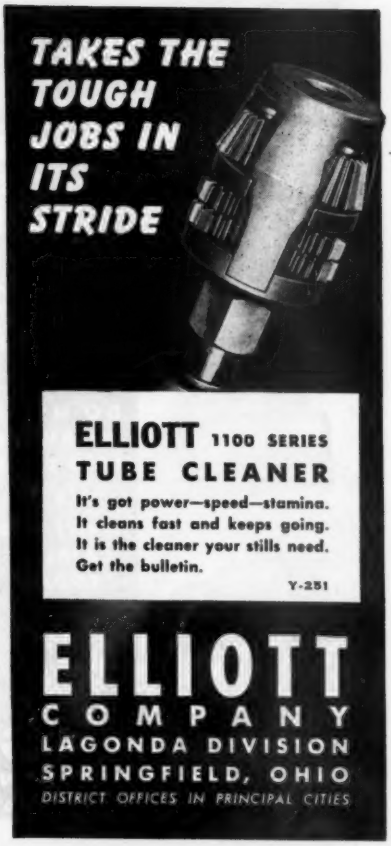

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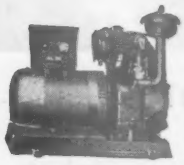

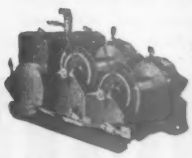

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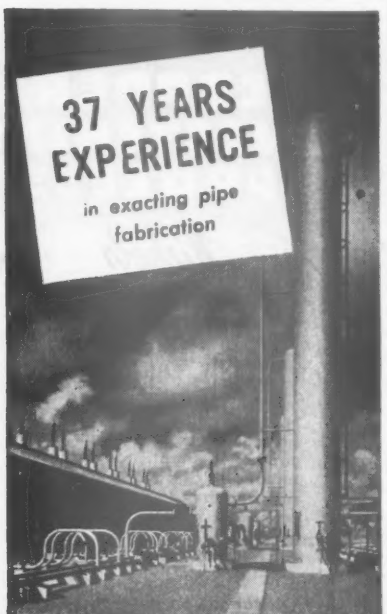


Texas
PIPE BENDING
Company
Pipe Fabricators
HOUSTON TEXAS

where it is used as a thinner. It also is used in preparation of drugs, dyes, benzoate of soda and other food preservatives, linoleum, oilcloth, and certain vegetable oils.

Jefferson Chemical Co. to Have Plant at Port Neches

NEW YORK.—Jefferson Chemical Co., owned jointly by The Texas Co. and American Cyanamid Co., will erect a large chemical plant on a 1,091-acre tract adjacent to The Texas Co.'s asphalt and roofing plant at Port Neches, Tex. Products will include intermediate chemicals for the manufacture of synthetic rubber, plastics, textiles, and other materials from petroleum and petroleum gases. The Texas Co.'s Port Arthur refinery will supply raw material.

American Cyanamid Co. is acquiring about 900 acres just east of the Jefferson site, with 2,500 ft. fronting on the Neches River, and will erect a chemical plant utilizing some of the products manufactured by Jefferson.

Factors influencing the choice of Port Neches for the new chemical plant, said H. L. Derby, president of Jefferson, were excellent facilities for water and land transportation, availability of labor in the area, a ready supply of fresh water, power, and fuel gas, and excellent waterfront facilities.

"The plant comprises the first unit of what will ultimately be a very large operation on this site," said Derby. "At the peak of construction about 850 people will be employed, and the completed plant will employ about 150 men and women. We expect to break ground in November or December of this year, and construction will take about a year."

Plans are being drawn up by Jefferson's engineering department in New York and contracts are being negotiated for construction of the major processing units and for the purchase of fresh water, electric power, and fuel gas.

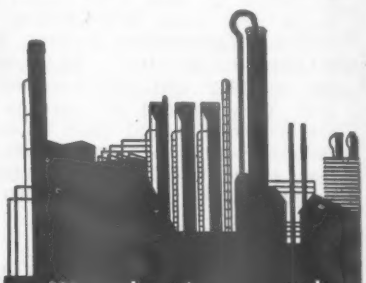
It is planned to install initially on the Jefferson site a combination laboratory and office building, locker building, and gate house, all of brick construction.

Motor Fuel Is Better Than Octane Number Indicates

NEW YORK. — Postwar motor fuels will provide better performance in the vehicles for which they were designed than is indicated by their octane numbers, Harry L. Moir, Pure Oil Co. technical adviser, predicts. The new gasolines are products of exhaustive research before and during the war, and some practices regarding evaluation of gasoline properties have become outmoded, he says.

One of these practices, according to Moir, is that of designating the quality of a fuel by a single value, such as octane number. The octane number is generally defined as a single number, obtained when a sample of fuel is tested on a laboratory test engine under controlled conditions. However, this single-number evaluation does not predict in most cases the performance of the fuel in a passenger or truck engine under actual road conditions.

Among other properties of gasoline which are of major importance are chemical composition, to assure proper balance of antiknock constituents; induction period, to insure stability of the fuel in storage; distillation range, of prime importance in designing a fuel with proper starting ability and proper economy; freedom from vapor lock, which is determined by the vapor pressure of the fuel; and many others which the petroleum technologist considers in the manufacture of gasoline.



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No. 14 Diaphragm Motor Valve with pilot valve and Davis No. 162D Packless Float Box.

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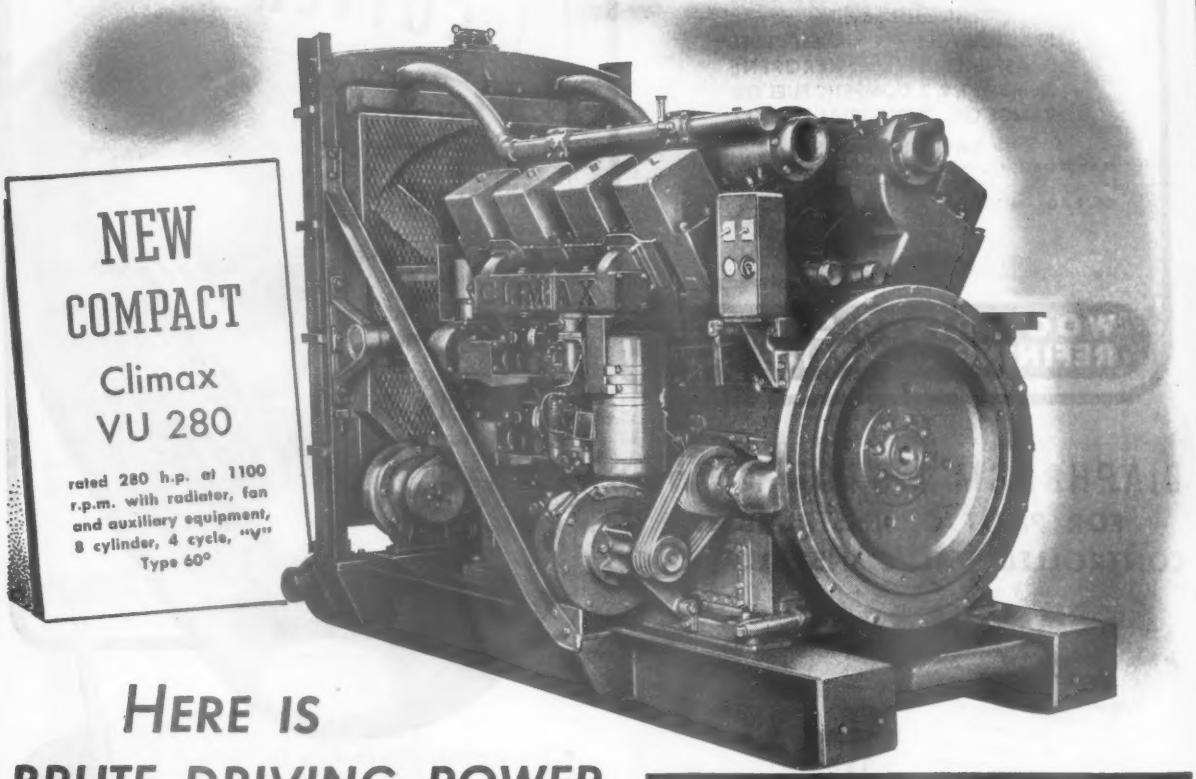

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Exploration and Drilling

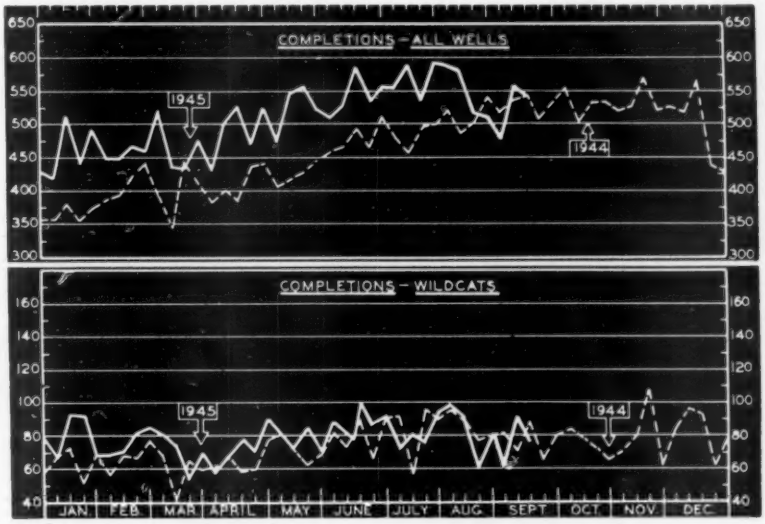
Week's Highlights

OPENING of a new Wilcox sand pool in northwestern Pottawatomie County, Oklahoma, on the west side of the Seminole Uplift, has several significant aspects for the geologists. The new pool, named Dale, was opened by L. B. Jackson who died in Tulsa September 17 and Deep Rock Oil Corp. 1 Rose, NW SE NE 26-11n-2e, good for 500 bbl. daily from Wilcox sand at 5,805-12 ft.

There has been a substantial and successful play going on in the Seminole district for some time, hunting for and finding good production in the various Pennsylvanian sands. These were overlooked in the big Seminole boom of the late 1920's, in the grand rush to complete wells quickly in the Wilcox sand. Profitable production has been developed since, in the Calvin, Sonora, Earlsboro, Booch, and Cromwell sands.

The new Wilcox discovery indicates that there are other possibilities. The main Wilcox play during the boom was on the top of the uplift, where local highs on the regional feature were found to be prolific producers. There will now be an intensified play along the west side of the uplift, searching for Wilcox production down dip off the main high. This will call for sharpshooting techniques, and the careful correlation of all the data and tools in the geologists' equipment. At least two major problems are involved.

First is the question of porosity in the Wilcox. Although it goes over the top and down the flanks of the uplift in a blanket, there are variations in porosity and permeability



Solid line charts current weekly completions, service wells in Eastern area included

WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 15, 1945

	Total of all wells					Cum. to date		Wildcat completions and discoveries					Cumulative total, 1945				
	Comp.	Oil	Gas	Dry	Footage	1945	1944	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	32	16	0	*16	46,708	1,019	1,125	0	0	0	0	0	0	0	0	0	0
Pennsylvania	91	48	10	†33	158,911	2,916	2,884	0	0	0	0	0	0	0	0	0	0
West Virginia	16	1	11	4	44,098	572	613	0	0	0	0	0	0	0	0	0	0
Ohio	24	5	8	11	58,687	647	697	0	0	0	0	0	0	0	11	42	53
Indiana	1	1	0	0	2,418	133	163	0	0	0	0	0	5	0	0	22	27
Kentucky	10	5	2	3	22,158	367	513	2	0	0	2	4	10	0	2	36	57
Illinois	55	39	0	16	149,718	1,244	1,303	1	0	0	9	10	35	0	0	220	255
Michigan	11	2	0	9	32,348	521	446	0	0	0	7	7	7	0	3	181	191
Kansas	32	19	4	9	105,516	1,193	1,275	0	0	0	3	3	26	0	12	242	280
Neb., Mo., Iowa	0	0	0	0	0	18	26	0	0	0	0	0	0	0	0	13	13
Oklahoma	52	29	2	21	185,466	1,689	1,236	3	0	1	11	15	64	2	15	260	341
Texas	123	75	12	36	618,248	5,034	3,895	4	0	2	17	23	152	12	45	887	1,096
North Central	30	20	2	‡8	88,942	1,527	1,041	2	0	0	2	4	58	0	5	314	377
West	27	24	0	3	150,467	1,264	1,084	0	0	0	1	1	41	1	0	183	225
Panhandle	6	1	4	1	17,608	395	173	0	0	0	0	0	0	0	1	5	6
Eastern	7	1	2	4	41,560	235	226	0	0	0	1	1	5	6	1	58	70
Gulf Coast	36	21	3	12	245,005	1,143	873	2	0	1	6	9	35	4	30	195	264
Southwest	17	8	1	8	74,666	470	498	0	0	1	7	8	13	1	8	132	154
Louisiana	21	14	3	4	138,824	726	561	0	0	0	1	1	24	3	6	91	124
Northern	12	6	2	4	59,951	283	220	0	0	0	1	1	6	1	6	51	64
Southern	9	8	1	0	78,873	443	341	0	0	0	0	0	18	2	0	40	60
Arkansas	2	2	0	0	7,305	124	156	0	0	0	0	0	0	0	0	28	28
Mississippi	10	6	0	4	75,658	253	100	0	0	0	3	3	5	0	0	83	88
Southeastern	3	0	0	3	9,470	43	32	0	0	0	3	3	0	0	1	30	31
Montana	13	10	0	3	26,981	227	254	0	0	0	1	1	7	0	0	19	26
Wyoming	9	4	2	3	39,091	149	119	0	0	1	3	4	14	0	1	29	44
Colorado	2	2	0	0	13,040	28	25	0	0	0	0	0	1	0	1	5	7
New Mexico	5	4	0	1	18,027	302	279	0	0	0	1	1	8	0	4	44	56
California	24	21	0	3	114,459	1,639	1,408	0	0	0	1	1	2	0	2	166	170
Total United States	536	303	54	179	1,867,131	18,844	17,110	10	0	4	62	76	369	17	103	2,398	2,887
Total previous week	557	284	56	217	1,872,755	18,308	16,565	16	0	2	73	91	359	17	99	2,336	2,811
Total Sept. 16, 1944	538	302	43	193	1,714,466	17,110	12,213	13	0	3	73	89	314	20	90	2,269	2,693

Service wells included: *16, †30, ‡1.

of the sand on the flanks, so that good reservoir conditions are not always present.

Second, because Wilcox oil here appears to be Ordovician in origin, any trap found must be checked to determine whether or not it had enough closure during Wilcox time to serve as a trap. There has been subsequent folding in this region, which has intensified earlier structures. Consequently the closures now found are usually greater than those that existed during Wilcox time. Unless there was some closure in Wilcox time, what are now traps on the flank of the uplift may well have been open during the Ordovician, and incapable of holding any oil.

SOUTH LOUISIANA

Activity Increasing and Greater Depth Projected

NEW ORLEANS.—Activity has been increasing in the South Louisiana area during the past 2 weeks, and drilling is projected to lower levels. This is evidenced by permits having been granted this week for four 12,000-ft. tests in the area. They are as follows: Humble Oil & Refining Co. 1 Baist Cooperage & Lumber Co., Inc., wildcat in the Bayou Sorrell area of Iberville Parish, in 92-10s-10e; Tide Water Associated Oil Co. 2-C Manhattan Land & Fruit Co., Venice field of Plaquemines Parish, 23-21s-30e; Gulf Refining Co. 1-E. St. Martin Land Co., at Bayou Boullion in St. Martin Parish, 26-9s-8e, and Union Oil Co. of California 1 John E. Foelkes, in the Houma area of Terrebonne Parish, 9-17s-17e.

Two wildcat tests are drilling below the 13,000-ft. level. Continental Oil Co. and Yegua Corp. 2 A. Dobbertine, 9-15s-14w, in the Johnson Bayou area, Cameron Parish, is drilling ahead from 13,008 ft. in shale and sand. The Texas Co. 1 State-Barataria Bay, wildcat in Jefferson Parish, in East Barataria Bay-T-20s-25e, is drilling ahead near 13,500 ft.

Gulf Refining Co. completed 15 Lafourche Basin Levee District, 11-18s-25e, at Lake Hermitage, in Plaquemines Parish, as a gas-condensate producer, flowing 87 bbl. per day through a 5/32-in. choke, tubing pressure 4,300 lb. Total depth 11,632 ft., with perforations above 11,486 ft.

Nine new locations were reported this week with only one wildcat test in Jefferson Davis Parish. West Tepetate field led with two locations. All nine completions were in proven areas, eight being oil and one gas. Acadia, Jefferson Davis, and Plaquemines parishes each had two completions.

TEXAS GULF COAST

Chambers County Discovery Completed

HOUSTON.—A new oil pool has been opened by Butcher-Arthur, Inc., in the Cedar Bayou area of Chambers County. Its 1 First National Bank of Goose Creek, in the Christian Smith Survey, Abstract 22, about 6 miles northeast of Goose Creek, flowed a potential of 259 bbl. per day through a 10/64-in. choke, tubing pressure 1,850 lb., casing pressure 2,750 lb., gas-oil ratio 1,050 to 1, gravity 35°. Production is through 24 perforations at 7,181-83 ft. in the lower Frio, with 2-in. tubing set at 7,165 ft. Total depth is 7,517 ft., and 5½-in. casing was set near bottom.

A new Wilcox sand discovery well, 2 miles southeast of New Ulm, in western Austin County, has been completed by Sinclair Prairie Oil Co. at 1-A W. A. Schweke, James Tylee Survey. The discovery well flowed a potential of 117 bbl. per day through a ¼-in. choke, tubing pressure 195 lb., gas-oil ratio 1,509 to 1, gravity 34°, 2 per cent water. Top of the Wilcox oil sand at 9,151 ft. Production is through 100 perforations at 9,155-65 ft. 2-in. tubing at 9,123 ft. Total depth is 10,013 ft., with a plugged-back depth of 9,180 ft. Original plans were to dual-complete this well, also opening the 9,237-56-ft. gas-condensate sand but a complete seal between the two pays was unsuccessful so the lower perforations were squeezed off and plug was set above.

There were 19 new locations reported this week, 5 of which are wildcats, 1 each in Chambers, Fort Bend, Jackson, Jefferson, and Liberty counties. Of the 15 completions, 5 are wildcats, and 2 were oil discoveries, in Austin and Chambers counties. Chambers County led with three completions.

SUCCESSFUL WILDCATS COMPLETED IN UPPER GULF COAST

Austin County: New oil pool, New Ulm field—Sinclair Prairie Oil Co. 1 W. A. Schweke, Tract "A", James Tylee Sur., Abst. 304, 2 mi. SE of New Ulm townsite, top Wilcox sand 9,151 ft., TD 10,013 ft., PB TD depth 9,180 ft., perf. 100 holes, 9,155-65 ft., PT 117 bbl., ¼-in. choke, gas-oil ratio 1,509 to 1, TP 195 lb., gravity 34°, 2 per cent water.

Chambers County: New oil pool, Cedar Bayou field—Butcher-Arthur, Inc. 1 First National Bank of Goose Creek, Christian Smith Sur., Abst. 22, 6 mi. NE of Goose Creek, top sand 7,181 ft., TD 7,517 ft., perf. 24 shots 7,181-83 ft., PT 259 bbl. per day through a 10/64-in. choke, gas-oil ratio 1,050 to 1, TP 1,850 lb., CP 2,750 lb., gravity 35°.

WILDCAT FAILURES COMPLETED IN UPPER GULF COAST

Jackson County: Wright Drilling Co. 1 Fred Westhoff, Thos. Menefee Sur., Abst. 52, 5 mi. SE of Edna, dry at 7,004 ft.

Polk County: Pfiffner & Ryan 1 Caroline B. Doyle Hrs., in A. Viesca 7 Lg. Gr., 2 mi. SW of Goodrich, dry at 7,510 ft.

Wharton County: Humble Oil & Refining Co. 1 Mary G. Willis, ETRR Sur., Abst. 111, Sec. 35, 4.2 mi. SW of El Campo, dry at 6,900 ft.

SOUTHWEST TEXAS

New Gas Pool Opened In Jim Wells County

CORPUS CHRISTI.—A new gas discovery in Jim Wells County to be known as the Naylor pool has been opened by H. M. Naylor Oil Co. 1 Lillian Muil, Los Presenos De Abajo Grant, Abstract 171, Share 3, 2 miles north of Agua Dulce. The discovery well flowed 12,000,000 cu. ft. of gas on a 24-hour potential test, no water, no oil. Shut-in. pressure is 1,030 lb. Production is from sand at 3,974-84 ft.

A new gas pool in Duval County has been opened by Cox & Hamon at 4 Clara Driscoll, 13 miles west of Benavides, in Santa Rosalia Grant, Section 55. It showed for a gas well on a test, and was shut in without a gage. On a ⅜-in. choke the tubing pressure was 880 lb., and casing pressure 1,050 lb. The casing was perforated with 12 shots at 3,170-72 ft. and 18 shots at 3,175-78 ft. Total depth is 3,226 ft., with 5½-in. casing set at 3,215 ft.

New oil production is being opened in Victoria County, 10 miles east of Telferner, by Rowan & Hope 3 Sally Ragsdale, in the Jas. McConnaughey Survey, Abstract 262. Drilled to a total depth of 4,453 ft. with 5½-in. casing on bottom, perforations were made at 4,436-42 ft. and 4,443-49 ft., and on test through a ½-in. choke, tubing pressure was 925 lb., casing pressure 300 lb.

There were 31 locations reported this week, 6 being wildcats, 1 each in Duval, Goliad, Nueces, San Patricio, Starr, and

DAILY AVERAGE PRODUCTION FOR WEEK

	Sept. 15 crude oil	Distillate, allied products	September PAW quota all oils	Sept. 8 crude oil
Alabama	1,000	.....	500	1,000
Arkansas	78,800	5,400	80,400	78,800
California	883,250	60,970	946,970	880,400
Colorado	11,550	.....	12,000	11,300
Eastern	60,000	6,300	72,500	68,650
Florida	Shut in	.....	.....	.....
Illinois	201,450	12,000	212,000	205,050
Indiana	13,100	.....	13,000	14,650
Kansas	273,600	4,500	278,500	255,200
Kentucky	28,150	2,600	30,600	28,500
Louisiana	363,200	42,000	392,000	362,650
North Louisiana	71,200	.....	.....	70,650
South Louisiana	292,000	.....	.....	292,000
Michigan	51,100	800	47,800	48,800
Mississippi	53,700	.....	47,000	55,750
Montana	23,300	300	22,300	23,300
Nebraska	850	.....	1,000	850
New Mexico	107,250	6,800	106,800	107,250
Oklahoma	392,050	28,000	408,000	391,150
Texas	1,889,500	166,000	2,144,000	1,889,500
East Texas	315,300	.....	.....	315,300
East Central Texas	128,450	.....	.....	128,450
North Central Texas	141,900	....	.....	141,900
Texas Panhandle	88,000	.....	.....	88,000
West Texas	452,000	.....	.....	452,000
Southwest Texas	296,150	.....	.....	296,150
Texas Gulf Coast	467,700	.....	.....	467,700
Wyoming	104,750	3,500	96,700	102,950
Total United States	4,536,600	339,170	4,912,070	4,525,750
Change from previous week	up 10,850			

Total production January 1-September 15, 1945 ..... 1,241,294,125 bbl.
Same period last year ..... 1,167,325,750 bbl.

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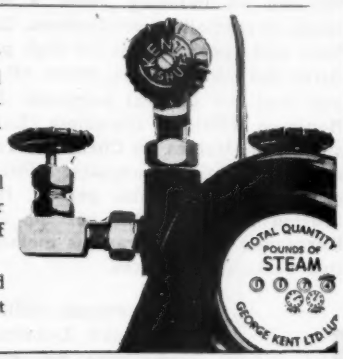

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Name_____
Address_____
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Willacy counties. The Willamar pool led with nine locations reported. Of the 38 completions reported 12 were wildcats, 2 being gas discoveries, 10 dry holes, including 1 each in Bastrop, Calhoun, Duval, Jim Hogg, Karnes, Kerr, McMullen, Val Verde, Victoria, and Wilson counties. Duval County led with five completions. Starr County was next with three completions.

SUCCESSFUL WILDCATS COMPLETED IN SOUTHWEST TEXAS

Duval County: New gas pool — Cox & Hamon 4 Clara Driscoll, Santa Rosalia Gr., Sec. 55, 13 mi. W of Benavides, top sand 3,168 ft., TD 3,226 ft., perf. 12 shots 3,170-72 ft., and 18 shots at 3,175-78 ft. Completed as a gas well, no gage. On ⅜-in. choke TP was 880 lb., and CP 1,050 lb. Now shut in.

Jim Wells County: Naylor gas pool discovery—H. M. Naylor Oil Co. 1 Lillian Muil, Los Presenos De Abajo Gr., Abst. 171, Share 3, 2 mi. N of Agua Dulce, top of sand 3,974 ft., TD 6,400 ft., perf. 3,974-84 ft., PT 12,000,000 cu. ft. of gas per day, on open flow, no oil, now shut in, tubing pressure 1,030 lb., no water.

WILDCAT FAILURES COMPLETED IN SOUTHWEST TEXAS

Bastrop County: G. A. Gamble 1 Charles Wolf, Jos. Doyle Lg., Tract 10, Chas. Wolf Subd., 5 mi. SW of Cedar Creek, dry at 1,605 ft.

Calhoun County: P. R. Rutherford 1 Thos. P. Traylor, Agaton Sisneror Sur., 4 mi. SE of Bloomington, dry at 7,143 ft.

Duval County: Parker & McCune 1 Miller Ranch Co., Diego Hinojosa Gr., Blk. 10, 7 mi. NE of Hebbronville, dry at 4,712 ft.

Jim Hogg County: Harrison & Daubert 1 Guiterrez, TTRR Sur. 163, 14 mi. SW of Hebbronville, dry at 3,798 ft.

Karnes County: Bennett Bros. Drilling Co. 1 O. A. Mudd, Carlos Martinez 15-Lg. Gr., 3 mi. S of Green, in Burnell area, dry at 6,708 ft.

Kerr County: Phillips Petroleum Co. 1 C. O. and N. H. Whitworth, W. G. Wharton Sur. 10, 30 mi. SW of Kerrville, dry at 6,618 ft.

McMullen County: Fred W. Shield 1 W. D. Glasscock, M. F. Lowe Sur. 16, 7 mi. W of Clegg, dry at 8,011 ft.

Val Verde County: J. A. Green 1 John Ingram, Sec. 3, Blk. S, ELRR Sur., 7 miles N of Langtry, dry at 2,050 ft.

Victoria County: Hewit & Dougherty 1 Josephine Mitchell Est., Placedo Benavides Sur., 5 mi. NE of Placedo, dry at 8,008 ft.

Wilson County: Quintana Petroleum Corp. 1-A Annie L. Moore, David O. Warren League, 4 mi. SW of Dewville, dry at 9,176 ft.

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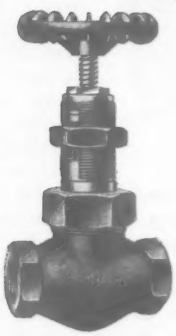

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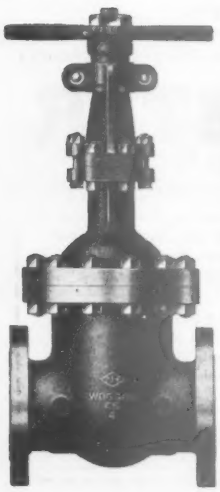

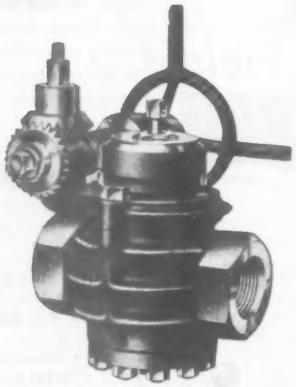

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CALIFORNIA

Prospective New Pool Discoveries Unchanged

LOS ANGELES. — There has been no change in the status of Ohio Oil Co.'s Gardena wildcat or Standard Oil Co. of California's Leffingwell wildcat during the past week. Ohio killed its Gardena wildcat a week ago in order to effect a squeeze job in an effort to overcome water trouble that developed immediately subsequent to completion. The cement has been drilled out and swabbing operations are again under way. This wildcat showed oil on a production test a few weeks ago but the volume of gas was a distinct disappointment.

In the Leffingwell Ranch area, between Santa Fe Springs and West Coyote fields, Standard of California resumed operations several days ago and is coring ahead at 10,431 ft. A string of 7-in. casing was landed a week or so ago at 10,145 ft. but it is unknown whether the oil sand reliably reported to have been found is behind the shoe or below.

Standard has suspended work on 42-28-F in 28-20s-16e at Pleasant Valley. This well has a string of 7-in. landed at 9,110 ft. and 152 ft. of 5½-in. liner landed at 9,169 ft. On a flow test last summer the well flowed at a daily rate of 564 bbl. daily cutting 50 per cent water but increased to 80 per cent.

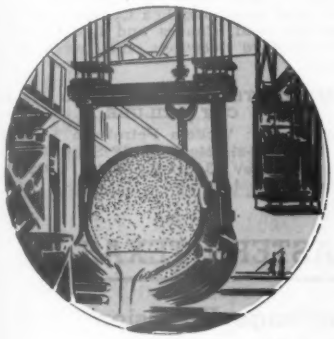
The Lloyd Corp. extended the Paloma field several days ago by completing its well 54 in 34-31s-26e, flowing 760 bbl. daily. Its completion will add another 80 acres to the Paloma unit plan after it has produced for a period of 30 days.

With deep tests under way in both the Middle and South domes of Kettleman Hills, the prospects of these districts for production should be determined within another 30 days. The objective of both wells is the Eocene which has proved productive in the North Dome below the Temblor of Miocene age. The Middle Dome showed small production in the Temblor but after yielding 544,491 bbl. of crude oil the wells reached the point where it was no longer economical to produce and all but one well were subsequently abandoned. It is the latter well that Standard is carrying down into the Eocene for a conclusive test.

CALIFORNIA WILDCAT FAILURE

Kern County, Kern Bluff: Capital Co. 1 Kloffenstein, 24-29s-28e, bottomed in gray shale and shells, ran electric log. Pyramid Hills sand 5,775 ft., upper Vedder 5,896 ft., lower Vedder 6,147 ft., all sands gray and barren, TD 6,163 ft.

The number of completions registered this week were abnormally low with the result that locations were more than



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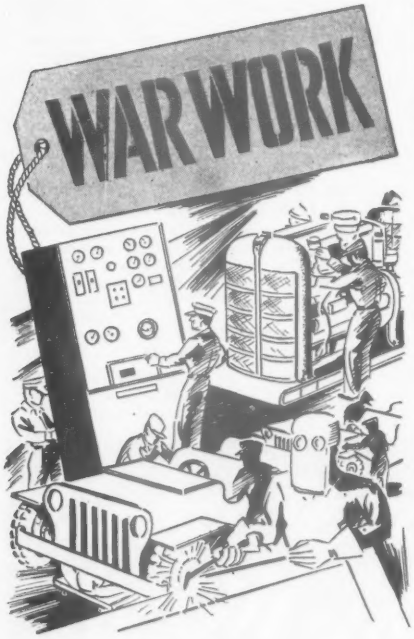

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double the number of completions. Los Angeles Basin headed the location list with a total of 30. This covers 16 locations at Wilmington, 5 at Torrance and 3 each at Newport and West Coyote. One wildcat location was made and locations for 3 additional gas tests recorded. San Joaquin Valley fields had 18 locations and the Coastal district showed 7.

PERMIAN BASIN

Goldsmith Test Has Oil Show in Silurian

MIDLAND.—Stanolind Oil & Gas Co. 3-Q Scharbauer, Section 12, Block A, Public School Land Survey, deep test on the north end of the Goldsmith pool, Ector County, took a 2-hour drill-stem test in the Silurian from 7,969-8,011 ft. It had sweet gas in 20 minutes and recovered 295 ft. of oil and gas-cut mud. It was drilling ahead at 8,011 ft. in chert to explore the Ellenburger. The test indicated production in both the Clear Fork and the Wichita-Albany. Cities Service Oil Co. will drill a 10,500-ft. Ellenburger wildcat on the west side of the Harper pool in central Ector County. It is 1 J. E. Parker in the center of the southeast quarter of the northeast quarter of Section 20, Block 44, T-2-S, T&P Survey.

Sinclair Prairie Oil Co. 1 Jessie Mae Williamson, Section 40, Block 45, T-1-N, T&P Survey, 2½-mile northwest extension to the TXL pool in Ector County, swabbed 75 bbl. of oil in 21 hours at 7,877 ft. after being washed with 600 gal. of mud acid. This test was in the Devonian, the well having been plugged back to 8,050 ft. from 9,923 ft. where it failed in the Ellenburger. Atlantic Refining Co. 1-C TXL, in the TXL pool, has been completed in the Devonian to flow 885 bbl. of 41° gravity oil in 24 hours. Production is through perforations from 7,950-8,050 ft.

Amerada Petroleum Corp. 1-A E. H. Jones, Section 3, Block A-6, Public School Land Survey, wildcat in northwestern Gaines County, on a 38-hour drill-stem test in the Devonian from 11,422-428 ft., recovered 3,420 ft. of dry drillpipe, 2,880 ft. of oil cut 1 to 6 per cent by water and 4,110 ft. of salt water. Gravity of the oil was 39.79°. Operator will squeeze perforations and test higher in an effort to shut off water. The test is 4½ miles southwest of the Wasson pool and 7 miles northwest of the Russell pool, both Permian lime producing areas. The Texas Co. 1-B Parmer, Labor 12, League 317, Parmer County School Land Survey, southeastern Gaines County wildcat, was drilling below 5,258 ft. in lime with no shows reported.

Humble Oil & Refining Co. 88-X Means, Section 9, Block A-35, Public School Land Survey, deep test in the Means pool, took a 2-hour drill-stem test from 13,228-401 ft. and recovered 7,500 ft. of sulfur water with no shows. It was drilling ahead at 13,412 ft. in lime and shale. Stanolind 1-BB University, Section 17, Block 11, University Lands, southeast offset to the discovery in the Three Bar pool, ran a 2-hour drill-stem test from 7,078-7,185 ft. in the Wichita-Albany, showed gas to the surface in 29 minutes, gaging 343,000 cu. ft. daily, and recovered 125 ft. of heavily gas-cut drilling mud but no oil.

The Fullerton field, Andrews County, had five completions this week, while the Sand Hills Tubb field, Crane County, and the Keystone-Holt field, Winkler County, each had three. The Keystone-Holt and Keystone - Ellenburger fields, Winkler County, and the Leonard field, Runnels County, each reported two new locations.

WEST TEXAS WILDCAT FAILURE

Martin County: American Republics Corp. 1 Mrs. Anna Boehmke, Sec. 34, Blk. 35, T-1-N, T&P Sur., 6 mi. NE Stanton, elev. 2,573 ft., San Andres 3,520 ft., San Angelo 4,420 ft., Clear Fork 5,390 ft., dry, TD 7,003 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—DeKalb Agricultural Association 1 L. E. Elliott, 6-23s-38e, 2 miles south of Gulf Oil Corp. 1 Drinkard, Clear Fork discovery in southeastern Lea County, on a 3½-hour drill-stem test from 6,840-6,996 ft. showed sweet gas to the surface in 18 minutes, estimated at 1,000,000 cu. ft. daily, flowed 35 bbl. of 40° gravity oil hourly and recovered 1,700 ft. of oil and gas-cut drilling mud. Total depth is 6,995 ft. Stanolind Oil & Gas Co. 1 Jones, 19-19s-39e, wildcat 3¼ miles southeast of the Hobbs field in east central Lea, swabbed 63¾ bbl. of water with a trace of oil in 4½ hours from 7,790-7,923 ft. The test was plugged back to 7,938 ft. from 10,580 ft. It was plugging back farther in order to test the San Andres section. Continental Oil Co. 1 B-22 Skaggs, 22-20s-37e, one-half mile northwest outpost to the Skaggs deep pool in Lea County, ran a 30-minute drill-stem test from 6,628-6,704 ft., but had no showing of oil or gas. This test was above the regular pay. It was drilling below 7,020 ft. in lime.

Eddy County reported three field locations this week and Lea County had two. Caprock field, Chaves and Lea counties, led in field locations this week with four.

SOUTHEASTERN NEW MEXICO WILDCAT FAILURE

Lea County: Vickers Petroleum 1 Shell-State, 17-21s-34e, 3 mi. W South Eunice field, elev. 3,751 ft., Yates 3,922 ft., dry, TD 4,116 ft.

EASTERN TEXAS

Carthage Extension Well Has Showing

DALLAS.—Sun Oil Co. 1-A Neal, John Garner Survey, prospective oil discovery 4 miles north of Carthage and on the north flank of the Carthage gas-distillate field in Panola County, ran a 19-minute drill-stem test from 4,967-97 ft. and recovered 3,650 ft. of 30.9-gravity oil, with no water, and with 100 lb. working pressure. Total depth is 4,997 ft.

The Texas Co. 1 Ham, R. Lawson Survey, wildcat 3 miles east of Teague, Freestone County, set 7-in. casing at 8,233 ft. and was preparing to perforate the Rodessa Section, which was topped at 7,415 ft. Total depth is 8,451 ft. Northern Ordnance, Inc., 1 Lumpkin, J. E. Edwards Survey, wildcat 3 miles southwest of Dalby Springs, Bowie County, is dry at 7,020 ft. with no shows. Tops have not been released. Magnolia Petroleum Co. has staked 1 S. L. Orr, a 12,000-ft. wildcat in northwest Marion County, 3½ miles SW of Avinger. It is 1,300 ft. from the north line and 1,000 ft. from the west line of R. B. Fowler Survey.

Shell Oil Co., Inc., and Lone Star Producing Co. 1 Tandy, W. Martin Survey, 12 miles northeast of Centerville, deep test in the Buffalo Woodbine area of Leon County, has been completed for initial flow of 100,000,000 cu. ft. of gas in 24 hours, open flow, with 3 bbl. of distillate per million cubic feet of gas at plugged back depth of 5,791 ft. Rock pressure was 2,140 lb. Total depth was 10,802 ft. Sinclair Prairie Oil Co. 1 Schofner, William Dickerson Survey, Smackover test in the Chapel Hill field, Smith County, topped the Smackover lime at 11,900 ft. It was drilling below 12,608 ft. in shale and lime.

Carthage field, Panola County, had two completions, Winnsboro field, Wood County, and Jefferson field, Marion

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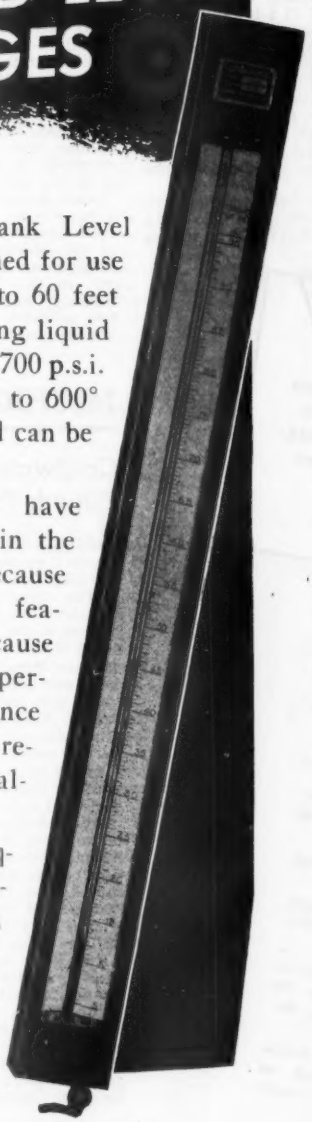

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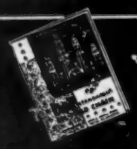

Union Bulletin O-1 covers Oil Field Chain. Ask for your copy.

ARMY NAVY

UNION CHAINS

County each had one. Henderson field, Rusk County, and Calvert field, Robertson County, each had two.

EASTERN TEXAS WILDCAT FAILURE

Navarro County: J. B. Daniels 1 Mrs. Geo. P. Bounds, Martin Latham Sur., 3½ mi. SE Richland, elev. 371, dry, TD 3,222 ft.

CANADIAN FIELDS

Two Producers Added in Steveville-Princess Pool

CHATHAM.—In the Steveville-Princess field, eastern Alberta, two California-Standard wells have been completed as producers. Princess-C.P.R. 38-22-A, LSD 15, 22-20-12w4, finished at 3,968 ft. with 105 bbl. initial production. Princess-C.P.R. 78-22-8 at 3,984.5 ft. started at 70 bbl. Two wells are testing, including Princess-C.P.R. 16-22-A coring in the Devonian, two are drilling and one starting.

Conrad.—In the Conrad field, southern Alberta, Conrad-Province 31-5-A, LSD 2, 5-6-15w4, finished at 3,019 ft., is pumping 60 bbl. of 26-gravity crude. Conrad-Province 17-32-B, LSD 16, 32-5-15w4, finished at 3,083 ft. is on the pump with initial production not determined. This completion indicates possible extension of the field to the southeast. Official figures on other recent completions are: Conrad-Province 17-5-A, LSD 16, 5-6-15w4, total depth 3,124 ft., 110 bbl. Conrad-Province 33-5-A, LSD 7, 5-6-15w4, 2,962 ft., 60 bbl. One well is located, one standing and one drilling.

Taber.—In the Taber field, southern Alberta, Commonwealth-Taber 1, LSD 11, 22-9-17w4, finished at 3,217 ft., is testing at 3,217 ft. with 35-bbl. production indicated. Taber-Province 47-15-A, LSD 13, 15-9-17w4, finished at 3,185 ft., is testing.

Kitscoty.—In the Kitscoty area, north and west of the Lloydminster field, North Peace Syndicate 1, LSD 4, 36-50-3w4, has finished as a commercial gasser with production at 1,924-33 ft. Production will be piped to the town of Kitscoty.

Wrentham.—In the Wrentham area, southern Alberta, Wrentham-Province 2, LSD 16, 12-6-17w4, drilled by California-Standard to test a potential southerly extension of the Taber production, has been abandoned at 3,470 ft.

Blood Reserve.—Foothills Oil & Gas Co., an Imperial Oil subsidiary which heretofore has limited its activity to Turner Valley has secured exploration permit covering 28,160 acres in the Lethbridge area on the north limits of the Blood Indian Reserve. It is planned to test the area where Northwest-Treaty 1, drilled by Imperial, got noncommercial oil shows at the Madison limestone contact.

Keystone Valley.—In the Keystone Valley, in the foothills north and west of Calgary, Roxana 3-K, LSD 7, 31-27-6w5, has spudded the first wildcat in a previously untested area.

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MICHIGAN

Coldwater Pool Gains Fiftieth Producer

SAGINAW.—Except for another good well in the prolific Coldwater field of Isabella County, and a 150-bbl. producer in Bay County's Hampton pool, Michigan oil operators added only dry holes to the record in the past week as 11 tests were completed, 15 new locations announced.

Sohio Petroleum Co. 1 Wilson, Section 30, Coldwater, flowed 46 bbl. the first hour and became the fiftieth producer in the field discovered in August, 1944. Three other drillings in the field were reported under test.

Seven of the nine dry holes on the completions list were wildcat tests, including Sun Oil Co. 1 Eddy, southeast of the Sherman field, Isabella County. More drilling is in prospect for the north end of the Adams-Arenac field following on completion of the Teater-Rowmore well in Section 4, now the most northern producer in the field and drilled on a 40-acre lease bought last year from the state at an all-time record bonus of $54,000.

The state conservation department issued permits for three new tests in Arenac, two to Don Rayburn in Section 11 of Adams and one to Sun Oil Co. in Section 17, Arenac Township. Other locations include two each in Bay, Ottawa and Missaukee counties, one each in Allegan, Crawford, Osceola, Livingston, Newaygo and Mecosta.

MICHIGAN WILDCAT FAILURES

Clinton County, Lebanon Township: Allegan Pipe & Supply Co. 1 Whittaker Brothers, SW SW NE 22-8n-4w; dry in Dundee; TD 2,941 ft.

Isabella County, Sherman Township: Sun Oil Co. 1 C. K. Eddy & Son, C-NW 2-15n-6w; dry; TD 1,728 ft.

Midland County, Midland Township: Ashby Drilling Co. 1 Roy Ames, SW SW SE 36-14n-2e; dry; TD 4,406 ft.

Missaukee County, Forest Township: L. R. Reese 1 State-Forest, NW NW NE 19-23n-7w; dry in Dundee; TD 3,833 ft.

Montcalm County, Home Township: Ohio Oil Co. 1 Steve F. Myers et al, SE SW SE 21-12n-6w; dry in Monroe; TD 3,622 ft.

Osceola County, Hartwick Township: Gordon Oil Co.-Sohio Petroleum Co. 1 Paul H. Travis, SE SE NW 19-19n-8w; dry in Dundee; TD 4,232 ft.

Ottawa County, Olive Township: J. W.

Lang Co. 1 John Groters, NW NW SE 35-6n-16w; dry; TD 740 ft.

ROCKY MOUNTAIN

Big Sand Draw Given Second Tensleep Well

DENVER.—The second Tensleep oil sand well in Big Sand Draw, Fremont County, Wyoming, was completed by Sinclair-Wyoming Oil Co. in its 2 Unit, SW SW SW 11-32n-95w, flowing 392 bbl. in 24 hours at 7,970 ft. after plugging back from 8,138 ft. It is a north offset to 1 Unit, the discovery well, which was completed in December 1944, for 967 bbl. of 35.4-gravity oil the first 24 hours. The second well, only 1,320 ft. north of the discovery, ran approximately 600 ft. lower. It encountered a fault in the Embar horizon and upon passing through it redrilled 150 ft. of that section. The top of the Tensleep was at 7,897 ft. The oil flow was increasing at the end of the 24-hour test and is expected to be a better well than at first indicated.

South Elk Basin tests.—Kirk Oil Co. 1 Gill, NE NE NW 1-56n-100w, South Elk Basin, Park County, Wyoming, was dry at 2,332 ft. It was located 3¼ miles southeast of Continental Oil Co. 1 Ida Goodstein, NE SE SW 20-57-99, the discovery well, which was completed in the Tensleep last June for 594 bbl. on the pump in 24 hours. It was drilled to the Eagle sandstone as a marker, but top of that sand was not disclosed. Husky Refining Co. 1 Taggart, NE NW NE 12-56-100, a mile south of the Kirk well, was then abandoned at 261 ft.

Zimmerman Butte test.—Pacific Western Oil Corp. 1 Pacific Western, NW SW SW 36-44n-93w, an important Tensleep sand test on the Zimmerman Butte structure, Hot Springs County, Wyoming, in which that company, Frontier Refining Co., Barnsdall Oil Corp., and Continental Oil Co. have interests, topped the Frontier at 1,029 ft. and in a drill-stem test at 1,029-39 ft., open 30 minutes, showed for 100,000 cu. ft. of gas.

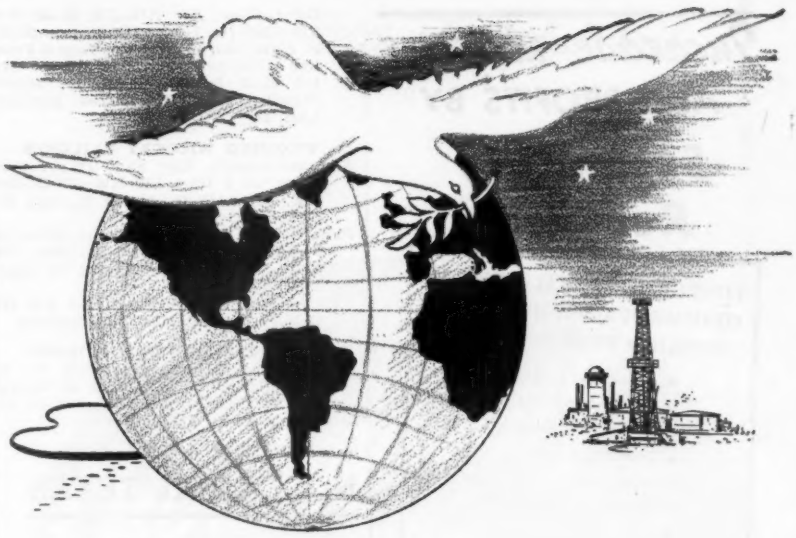
Eastern Colorado wildcat.—Union Oil Co. of California has released location for a joint test with the California Co. near Eads, Kiowa County, eastern Colorado, in 1 Union Pacific, SE SE SE 17-17s-48w. Location is approximately 14 miles north and 10 miles west of 1 Hostetter in Section 6-20-46, which was drilled to the Arbuckle sand at 5,540 ft., total depth, in 1937. That well had the Pennsylvanian at 3,400-4,915 ft., the Mississippian at 4,915-5,140 ft., and top of Arbuckle at 5,370 ft. Considerable interest in that territory has been shown recently and in addition to the large block held by the Union and California companies, Ohio Oil Co., Frontier Refining Co. and others have adjoining blocks.

New operations.—Eleven new operations were reported, of which three were in Colorado, one in Wyoming and seven in Montana. All are development wells except the three Colorado locations, which are wildcats. Continental made a new location in Wyoming and the others were distributed two in Cut Bank and five in Kevin-Sunburst in Montana. In addition to the Union-California wildcat in Kiowa County, Colorado, two are in Moffat County.

Completions.—Twenty-three wells were completed, of which 2 were in Colorado, 8 in Wyoming and 13 in Montana. Sixteen were oil wells with an initial production of 3,112 bbl., of which 855 bbl. were for Colorado, 2,072 for Wyoming, and 185 for Montana. One, East Muskrat, was a gas well and six were dry holes. Five were wildcats, all dry except the gas well.

WYOMING SUCCESSFUL WILDCAT

Fremont County, East Muskrat: Shannon



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Oil 1 State, SW NW NE 16-33n-91w, TD 4,585 ft., 7-in. 4,274 ft., completed as a gas well in first and second Frontier sands for 10,000,000 cu. ft. per day, top first Frontier 3,037 ft., second Frontier 3,200 ft., second Morrison 4,496 ft.

WYOMING WILDCAT FAILURES

Fremont County, East Sand Draw: Sand Draw Oil 1 Unit, SW NW SW 24-32n-95w, TD 6,115 ft., tested through the Dakotas, dry.

Park County, South Elk Basin: Kirk Oil 1 Gill, NE NE NW 1-56n-100w, TD 2,332 ft., dry after drilling to Eagle sand as a marker.

Husky Ref. Co. 1 Taggart, NE NW NE 12-56n-100w, TD 261 ft., abandoned.

MONTANA WILDCAT FAILURE

Toole County, Kevin - Sunburst: H. M. Kluth 1 Lewis, NE NE NE 21-33n-4w, TD 2,227 ft., top Sunburst 1,895 ft., Ellis-Madison 1,934 ft., dry.

N. CENTRAL TEXAS

Discovery Likely in Young County Area

WICHITA FALLS.—Kerlyn Oil Co. 1 Edwards, Block 1481, TE&L Survey, wildcat 5 miles north of Jean, Young County, ran a 30-minute drill-stem test from 5,106-13 ft. in the Mississippian, topped at 5,105 ft. It showed gas in 3 minutes and flowed a small head of oil in 22 minutes. Bottom-hole pressure was 2,375 lb. in 15 minutes. It is waiting on orders. Continental Oil Co. 1 Ramzy, D. K. Davis Survey, southeastern Jack County wildcat, 9 miles southeast of Jacksboro, was drilling below 5,473 ft. in shale after drilling dry conglomerate from 5,436-47 ft.

Robertson Drilling Co. 1 J. T. Richardson, Block 14, J. Scott Survey, wildcat 5 miles northeast of Olney, Archer County, has been completed for 1,688 bbl. of 40.5° gravity oil in 24 hours. Gas-oil ratio is 300 to 1. Production is from the Ellenburger at 5,170-5,220 ft. Continental Oil Co. 1 Stallings, Block 3252, TE&L Survey, southeastern Clay County wildcat, ½ mile southeast of Vashti, is dry at 7,115 ft. in the Ellenburger after drilling stain and odor of oil from 6,795-6,845 ft. Continental 1 Slaton, G. F. Lawrence Survey, wildcat 5 miles southeast of Bellevue, Clay County, drilled dolomite with stain and odor of oil from 6,285-6,300 ft. in the Simpson. A 30-minute drill-stem test was run from 6,288-6,304 ft. and 20 ft. of drilling fluid was recovered. Operator was repairing pump.

Archer County led this district in field completions with four, while Jack and Young counties each had three. Wichita County had nine new field locations and Archer County had five.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCATS

Archer County: New oil pool—Manning & Brown 1 A. P. Nichols, Sec. 50, Lot 2 ATNCL, 2 mi. W and 3 mi. N Huff, elev. 1,028 ft., Ellenburger 5,470 ft., flowed 407 bbl. day through 12/64-in. choke, perf. 5,486-5,543 ft., gravity 44.6°, gas-oil ratio 250, TD 5,543 ft.

Young County: New oil pool—Kerlyn Oil 1 J. W. Bryan, Sec. 1902, TE&L Sur., 3 mil. NE Jean, elev. 1,233 ft., Caddo 4,373 ft., flowed 439 bbl. day through 20/64-in. choke, perf. 4,373-81 ft., gravity 43°, gas-oil ratio 710, TD 5,576 ft.

WEST CENTRAL TEXAS

ABILENE.—Crown Central Petroleum Co. 1 B. A. Stephenson, Section 4, J. Winters Survey 138, Jones County wildcat 1 mile southwest of Hodges, although surrounded by dry holes, developed flowing production of 81 bbl. of oil in 8 hours from the Gunsight topped at 2,575 ft. One mile west of this new strike, West Central Drilling Co. has spudded 1 J. F. Winters in Subdivisions 1 and 2, John Winters Survey 138. Sohio Petroleum Co. will drill an Ellenburger wildcat in northeastern Nolan County, 6 miles southeast of Sweetwater. It is 1 Irl Favor, 661 ft. from the north line and 655 ft. from the west line of the NW Section 50, Block 21, T&P Survey.

Jones County had three field completions and two new field locations.

WEST CENTRAL TEXAS WILDCAT FAILURES

Shackelford County: James Blair Baker 1-A G. R. Davis, Sec. 1, Blk. 13, T&P Sur., 11 mi. W Albany, elev. 1,842 ft., dry in Cook, TD 1,685 ft.

Stonewall County: General Crude 2 W. J. Bryan, Sec. 11, Anolin & Williams, elev. 1,745 ft., dry, TD 6,501 ft.

LA.-ARK.

Ouachita County Has New Glen Rose Pool

MAGNOLIA.—Arkansas' first new pool for 1945 has been discovered in Ouachita County by McAlester Fuel Co. 1 Wesson, NE NE SW 24-15s-10w. Perforated opposite Glen Rose sand at 2,648-80 ft. is yielding five bbl. per hour of 33-gravity oil. Production is through a ½-in. choke. Arkansas wildcatters have had 28 failures this year, preceding this discovery. Immediate development is expected.

In North Louisiana, H. C. Owens 1 Critchton, NE 1-20n-8w, a wildcat in the

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Homer area of Claiborne Parish, had a show of oil in the Cotton Valley sand at 6,530-40 ft. Operators lost circulation at 6,565 ft.

Completions in Arkansas numbered only two this week. Stephens and Champagnolle each got one oil well. In the North Louisiana fields, there were 12 completions, with 6 oilers, 2 gas wells, and 4 dry holes, 1 of which was a wildcat try. Lake St. John added two oil wells, and Monroe gas field had two gas completions to take honors for the week. New locations about offset completions, with three new field starts for Arkansas, and 11 locations announced for North Louisiana. No wildcats are scheduled for either state this week.

NORTH LOUISIANA WILDCAT FAILURE

DeSoto Parish: G. H. Vaughn, Jr. 1 McGrew, SW SW 34-16n-14w, dry, TD 9,202 ft.

APPALACHIAN FIELD

West Virginia Test Finds Oriskany Dry

PITTSBURGH.—In Canaan Valley, on Blackwater anticline in Dry Fork district, Tuckere County, West Virginia, Ohio Oil Co. topped the Oriskany sand at 8,250 ft. in the wildcat on the Kuykendall unit and is drilling at 8,290 ft. There is a reported show of gas near the top of the sand but as it is being drilled with a rotary no drill-stem test has been made. The test is running low as the Onondaga Lime is recorded at 8,107 ft. which gives a thicker Corniferous section than in the Kaemmerling test and with a surface elevation of 3,342 ft., the Oriskany is minus 4,908 ft., or about 275 ft. lower than the original test and gas well on the structure.

On Briery anticline in Portland district, Preston County, W. E. Snee et al topped the Corniferous lime at 5,730 ft. in the wildcat on the Harry Sisler farm and the chert at 5,758 ft. and are drilling at 5,766 ft. This appears 62 ft. lower to the top of the chert than in the 1 Sisler which was dry through the sand and believed on the down-throw side of a fault. To the Tully (5,238-50 ft.), the test appeared to be running 400 ft. low but the section between the Tully and chert tinned and ran normal, evidencing that the major faults were crossed higher in the new test.

In Lincoln County, Harts Creek district, United Fuel Gas Co. completed a 1,476,000 cu. ft. gas well at 5,676 Huntington Development and Gas Co. through the Brown shale, total depth 3,690 ft.

In Harbor Creek Township, Erie County, northwest Pennsylvania, Appalachian Development Corp. drilled the test on C. R. Thornton farm to 2,228 ft. with no Oriskany sand present and it will be abandoned. There was a show of gas at 567 ft.

In Armstrong County, A. E. Klingensmith completed a good gas well on Doverspike-Lichanec tract in Bethel Township with the Murraysville sand topped at 1,334 ft. and 561,000 cu. ft. gas at 1,340-55 ft. and total depth 1,355 ft.

In Center district, Greene County, Union Gasoline and Oil Corp. completed a Silas Fordyce in the Little Dunkard sand, total depth and good for 27 bbl. a day, natural. This is remote from other oil production and may be a small local new pool.

New locations in West Virginia totaled 12 scattered in Harrison, Lincoln, Nicholas, Raleigh, Ritchie, Taylor, Wirt, Wood and one Oriskany test in Ravenswood district, Jackson County. In southwest Pennsylvania, new locations totaled 13, with 3 in Armstrong County, 2 in Clarion County, 1 in Greene County, 1 in Indiana County, 3 in Washington County, and 3 in Westmoreland County.

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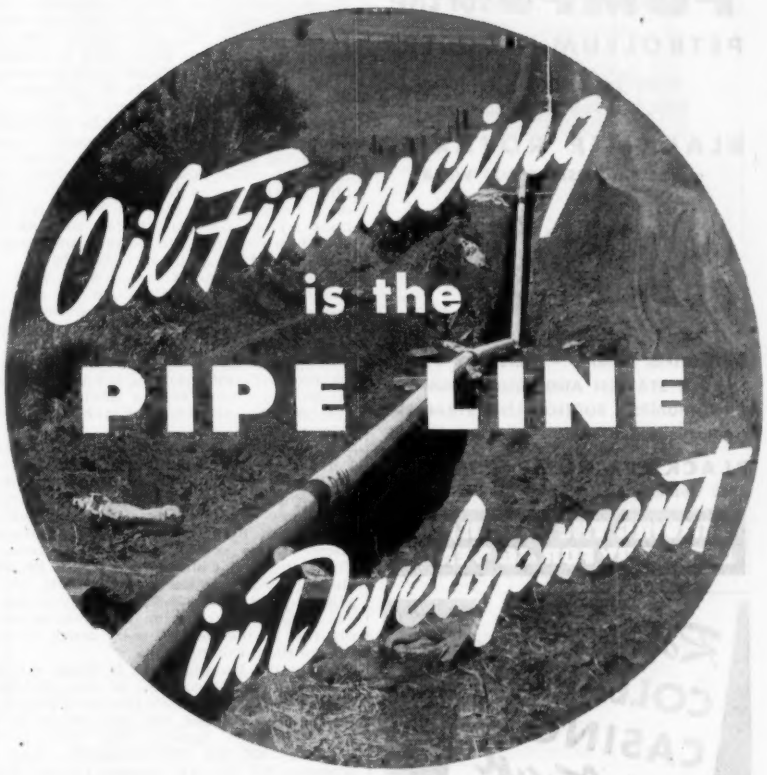

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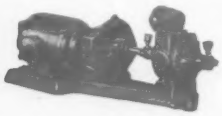

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OKLAHOMA

New Wilcox Sand Pool in Pottawatomie County

DEEP ROCK OIL CO. and L. B. Jackson 1 Rose, NW SE NE 26-11n-2e, a wildcat ½ mile west of the town of Dale, Pottawatomie County, Oklahoma, opened a Wilcox sand pool in a township in which there is no other production. The location is on a farmout from Stanolind Oil & Gas Co. The well flowed 129 bbl. of oil in 4½ hours from sand at 5,805-12 ft., with pipe set at 5,800 ft. It produced 69 bbl. the first hour. It is estimated to be good for 500 bbl. a day.

In the West Moore pool in Cleveland County, Mid-Continent Petroleum Corp. completed 2 Turk, SW SE NE 29-10n-2w, in Bartlesville sand, and it flowed 455 bbl. in 11½ hours through a 1-in. choke for 7 hours, and a 22/64-in. choke for 4½ hours. The hole was drilled to 7,980 ft. and pipe set near the bottom and perforated with 233 shots at 7,835-7,908 ft.

The West Edmond four-county field is about completely drilled up as far as inside locations go, and operators are now feeling out the edges. A very recent new location is Magnolia Petroleum Co. 1 Minnie Kibby, C NW NW 14-14n-4w, Oklahoma County. Among the dozen or so inside wells now testing about half the number are not showing the old West Edmond form.

About a mile northwest of Magnolia Petroleum Co.'s discovery well in the Chitwood area in Grady County, Magnolia will drill 1 Spiers, C SW SW 28-5n-6w. Same company was drilling below 6,850 ft. in 1 Britt, SE NW SW 3-4n-6w, about a mile southeast of the discovery. The latter is 1 Cunningham, C SE SE 33-5n-6w, producing gas and distillate from Wilcox sand at 10,879-882 ft. Only enough gas is being taken from the well to supply fuel in the field, this by order of the Corporation Commission.

In the old Hominy field in Osage County the H. F. Wilcox Oil & Gas Co. has a good well in Arbuckle lime at 2,793-2,817 ft. It flowed about 100 bbl. of oil in 3 hours through tubing. The well is 2 Wooster, NE SE NW 15-22n-8e. No. 1 Wooster, NE NE NW Section 15, was dry at 2,932 ft.

Superior Oil Co. of California 1 Manning, NE NE NW 27-22n-10w, Major County, a wildcat about 35 miles west of the Garber field, was drilled to 8,274 ft. Seven-inch pipe was set at 6,700 ft. and the well was reported to have flowed 250 bbl. in 7 days from intervals estimated at 6,705-31 ft. The well is a tight hole.

Ace Gutowsky 1 Crum, NW NW SE 24-13n-3w, Oklahoma County wildcat, which found water in the Wilcox sand, was testing at 6,915-49 ft. Cleveland sand at 5,724-31 ft. through perforations. Testing developed some oil and salt water.

OKLAHOMA SUCCESSFUL WILDCATS

Logan County: New oil pool—Texas 1 Arundel, SE NE SW 2-15n-1w, flowed 114 bbl. of 40-gravity oil from Bartlesville at 5,231-43 ft., TD 5,925 ft., Bartlesville 5,234 ft., May 5,325 ft., Woodford 5,400 ft., Hunton 5,480 ft.

Okfuskee County: New gas pool—Amerada 1 Canard, SE SE NE 16-10n-10e, 10,500,000 cu. ft. gas from Cromwell at 3,290-3,383 ft., TD 4,878 ft., Cromwell 3,284 ft., Arbuckle 4,472 ft.

Oklahoma County: Extension to Jones, Northeast—Stanolind et al 1 Bednar, NW NE SW 23-13n-1e, pumped 45 bbl. from Cleveland at 4,632-42 ft., TD 5,880 ft., Cleveland 4,637 ft., Oswego 4,945 ft., Woodford 5,435 ft.

Payne County: New oil pool—E. P. Halliburton 1 Drumm, NW SE SE 6-19n-4e, pumped 10 bbl. from Bartlesville at 3,729-38 ft., TD 4,249 ft., Wilcox 4,241 ft.

OKLAHOMA WILDCAT FAILURES

Bryan County: A. G. Hill et al 1 Stuart, NE SE NW 15-5s-11e, dry, TD 3,355 ft.

Canadian County: Fox & Fox 1 Simpson, SE SE SW 9-14n-5w, dry, TD 8,366 ft., Wilcox 8,280 ft.

Comanche County: Ashland & Klein, NE NE SW 9-1n-9w, dry, TD 2,736 ft., Arbuckle 2,674 ft.

Texas 1 Merkle, NE NE NE 28-3n-9w, dry, TD 7,983 ft.

Kiowa County: Fox & Fox 1 School Land, SE SE NW 36-7n-14w, dry, TD 936 ft., Pontotoc 765 ft.

McIntosh County: L. B. Jackson 1 Blankenship, N½ SW NW 33-10n-13e, dry, TD 1,202 ft.

Okfuskee County: Big Chief and Vickers 1 Kennedy, SW SE NE 4-10n-9e, dry, TD 3,350 ft., Cromwell 3,320 ft.

Wilcox 1 Beddoe, NE NW SW 32-11n-10e, dry, TD 3,285 ft., Cromwell 3,207 ft.

Stephens County: Skelly et al 1 Henry, SW SW SE 12-2s-5w, dry, TD 4,215 ft.

Jackson et al 1 Pruitt, SW SE SW 32-2s-7w, dry, TD 2,567 ft.

Washita County: Texas 1 Wolfe, NW SW SW 20-9n-20w, dry, TD 6,864 ft., Cisco 5,985 ft.

MISSISSIPPI

Southwest Extension Seen For Brookhaven Field

JACKSON.—The Brookhaven field of Lincoln County, which has heretofore had only one low-gravity pumping producer, has been given a 36-gravity oil-well extension. The well is Roeser & Pendleton 1 Case, 590 ft. north and 730 ft. west of SE cor. 8-7n-7e. The base of Austin was cut at 9,225 ft., Tuscaloosa at 9,395 ft., Marine Tuscaloosa at 9,981 ft., and sand at 10,238 ft. The well originally tested salt water from perforations at 10,238-68 ft., and squeezed. After another testing and another squeeze job, the cement was drilled out to 10,254 ft. and perforations at 10,238-54 ft. flowed an average of 12.5 bbl. of 36-gravity oil per hour through top and bottom, ¼-in. chokes, 8/10 of 1 per cent basic sediment and water.

In Adams County, C. H. Osmund 1 Armstrong-Ellislie, in 31-5n-2w, a rank wildcat, is drilling below 10,840 ft., after logging an oil and gas show. The Wilcox, topped at 4,690 ft., logged a show of oil at 5,532-42 ft. Base of chalk was cut at 10,260 ft., and a show of gas was reported at 10,520-10,630 ft.

Completions this week totaled 10, including 6 oilers and 4 dry holes, of which 3 were wildcats. Eucutta and Cranfield fields both had two completions, and the rest were scattered.

MISSISSIPPI WILDCAT FAILURES

Scott County: Carter 1 U.S.A., 2,000 ft. north and 1,998 ft. west of SE cor. 6-7n-7e, dry, TD 6,654 ft., Comanche 6,575 ft.

Stone County: Superior 1 Wilbe Lumber Co., SE SE 20-3s-10w, dry, TD 8,805 ft., base chalk 6,900 ft.

Yazoo County: Skelly 1 Bridgeforth, 2,310 ft. north and 330 ft. west of SE cor. 17-12n-2e, dry, TD 6,719 ft., Eutaw 5,059 ft.

ALABAMA WILDCAT FAILURES

Clarke County: California 1 White City Plantation Co., 740 ft. north and 854 ft. east of SW cor. 6-7n-1e, dry, TD 4,009 ft., Eutaw 2,448 ft.

Conecuh County: Hunt Oil 4 Miller Mill Co., 1,130 ft. north and 900 ft. east of SW cor. 13-4n-11e, dry, TD 2,845 ft.

Sumter County: J. H. Gwin 1 Allison Lumber Co., NE SW 36-19n-4w, dry, TD 2,616 ft., Comanche 2,605 ft.

ILLINOIS

55 Completions and 48 New Operations During Week

MATTOON.—An unusually busy week in Illinois fields resulted in the completion of 39 oil wells and 16 dry holes, a total of 55 completions. Initial production was 4,387 bbl., an average of 112 bbl. per well, the oil wells ranging from 7 bbl. to 400 bbl. in first-day output. Notably good new wells were completed in Richland, Wayne and Jefferson counties.

Joe Bander 1 Anna Schilt, NW NW NW 25-4n-10e, Olney East field, Richland County, started at 235 bbl. from McClosky lime at 3,067-71 ft., acidized. A. J. Slagter 1 J. H. Mullnax, NE NE NW 7-2n-10e, Calhoun pool, Richland County, had O'Hara lime at 3,118-27 ft., which yielded 384 bbl. initially, after an acid treatment. Another Calhoun well, C. R. Rose et al 1 A. Lame, NE SW NE 7-2n-10e, flowed 400 bbl., naturally, from Lower O'Hara at 3,137-44 ft.

Pure Oil Co. 5 M. G. Hoard, SE NW SE 23-2n-7e, Clay City, Wayne County, pumped 356 bbl. a day from McClosky lime at 2,998-3,006 ft.

Central Pipe Line Co. 1 Sumner Scott, SW SE NE 23-1s-3e, Divide West pool, Jefferson County, made 318 bbl. in 24 hours from acidized Rosiclaire lime at 2,711-28 ft. and McClosky lime at 2,749-51½ ft.

An old well worked over with success was Central Pipe Line Co. 1 Gadau, C N½ NW NE 6-1n-14w, Parkersburg pool, Wabash County, completed in McClosky lime in 1942 and good for 580 bbl. a day. Old total depth was 3,141 ft. Casing was milled at 2,844-59 ft. and production was increased from 8 bbl. a day to 210 bbl. a day, swabbing.

The Stokes pool in White County was extended by Pure Oil Co. 1 Brown-A, NE NE NE 1-6s-8e, which made 225 bbl. the first 24 hours from Hardinsburg sand at 2,664-72 ft.

The 48 new operations reported during the week included the following wildcats: The Texas Co. 1 E. Yount, NW SW NE 12-5n-7e, Clay County; Texas 1 H. Batts, NW NE NE 31-4s-4e, Jefferson County; Rock Island Refining Co. 1 Callinger, NE SW SW 25-1s-3w, Washington County; Ashland Oil & Refining Co. 1 D. Gailbraith, SE NE NE 20-7s-5e, Saline County; H. F. Robinson et al 1 Vaughn, SW SW SW 36-3n-1e, Marion County; J. J. Lynn 1 J. A. Gorings, NE NE SW 24-3n-7e, Clay County; Mohawk Drilling Co. 1 Lee Bunn, NE SW SW 23-3n-14w, Richland County; C. Baldwin 1 Kerwin, NW NW SW 28-3n-1e, Marion County; Hageman & Pond 1 E. Harris, NW NW NW 21-1n-10e, Edwards County.

ILLINOIS SUCCESSFUL WILDCAT

White County: Pure 1 Brown-A, NE NE NE 1-6s-8e, Hardinsburg sand 2,664-72 ft., TD 2,680 ft. Pumped 225 bbl. in 24 hours. Extends Stokes pool.

ILLINOIS WILDCAT FAILURES

Clark County: Grant Gallatin 1 Rothrock, NE SW SW 6-9n-13w, dry at 650 ft.

Clay County: Pure 1 E. D. Bayler-A, NW SW SE 2-2n-7e, dry at 3,156 ft. Menard 2,309 ft., Barlow 2,701 ft., Cypress 2,724 ft., Aux Vases 2,987 ft., McClosky 3,083 ft., St. Louis 3,142 ft.

Franklin County: Ashland 1 Old Ben Coal, SE NE SW 13-6s-1e, dry at 2,845 ft. Lower Glen Dean 2,103 ft., Barlow 2,311 ft.,. Aux Vases 2,598 ft.

Gallatin County: S. C. Yingling 1 J. W. Hardy, SE SE SE 5-8s-10e, dry at 2,195 ft. Vienna 2,098 ft., Tar Springs 2,138 ft.

Jefferson County: Ben Nation 1 Green et al, NW NE NE 7-2s-4e, dry at 2,995 ft. Menard 2,080 ft., Cypress 2,542 ft., Benoist sand 2,690 ft., Aux Vases 2,761

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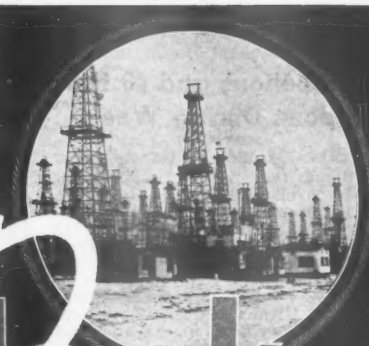

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SUMMARY OF AUGUST COMPLETIONS*

	Comp.	Oil	Prod.	Gas	Dry	Under 1,000 ft.	1,000-2,500 ft.	2,500-5,000 ft.	5,000-10,000 ft.	Over 10,000 ft.	Total footage	Rigs and drilling
New York	133	66	110	1	†66	0	132	1	0	0	191,000	167
Pennsylvania	312	160	570	21	‡131	8	285	18	1	0	473,570	422
West Virginia	66	10	152	39	17	1	35	27	3	0	121,650	93
Ohio	85	20	437	39	26	12	31	42	0	0	207,291	192
Indiana	43	10	694	6	27	9	26	8	0	0	72,322	50
Kentucky	115	61	3,115	17	37	16	66	33	0	0	203,968	73
Illinois	164	103	14,269	0	§61	3	48	113	0	0	488,724	204
Michian	59	23	7,831	5	31	0	32	26	1	0	146,136	144
Kansas	135	56	22,186	12	67	0	15	119	1	0	440,390	201
Neb., Mo., Iowa	2	0	0	1	1	1	1	0	0	0	2,819	5
Oklahoma	176	90	22,813	16	70	6	28	86	55	1	730,597	501
Texas	535	299	84,376	55	181	37	110	175	197	16	2,394,231	1,280
North	146	82	12,019	0	¶64	37	65	31	13	0	333,967	204
West Central	28	16	4,533	1	11	0	12	16	0	0	77,996	80
West	134	96	51,401	2	26	0	17	49	55	3	613,856	433
Panhandle	50	14	1,529	32	4	0	2	47	1	0	158,974	138
Eastern	19	9	2,017	7	3	0	0	2	17	0	126,967	128
Upper Gulf Coast	62	25	5,258	5	32	0	3	5	43	11	465,587	115
Lower Gulf Coast	60	42	6,119	5	13	0	0	8	51	1	408,031	105
South	40	14	1,299	3	23	0	10	15	14	1	177,289	64
South Central	6	1	201	0	5	0	1	2	3	0	31,544	13
Louisiana	75	45	8,668	5	25	5	8	12	29	21	536,015	207
Northern	30	15	2,415	4	11	5	8	11	6	0	103,789	94
Southern	45	30	6,253	1	14	0	0	1	23	21	432,226	113
Arkansas	15	11	625	0	4	0	5	6	4	0	61,648	40
Mississippi	30	15	2,601	0	15	0	1	4	22	3	194,921	78
Ala., Ga., Florida	3	1	35	0	2	0	0	3	0	0	10,478	19
Montana	20	12	779	0	8	0	10	7	3	0	77,555	85
Wyoming	20	16	6,397	0	4	1	4	11	4	0	73,336	78
Colorado-Utah	2	1	41	0	1	0	0	1	1	0	9,385	47
New Mexico	31	18	3,986	2	11	4	9	15	3	0	94,221	118
California	185	141	26,593	7	37	3	47	85	44	6	759,550	251
Total August	2,206	1,158	206,278	226	822	106	893	792	368	47	7,289,807	4,255
Total July	2,312	1,233	208,242	251	828	113	837	924	394	44	7,759,002	4,273

*Four weeks ending August 25, 1945. Service wells included: †66, ‡126, §1, ¶3.

ft., McClosky 2,906 ft., St. Louis 2,993 ft.

Fred Bragassa 1 no farm name, NE NE SE 12-2s-1e, dry at 2,366 ft. Menard 1,504 ft., Cypress 1,971 ft., Benoist 2,104 ft., Aux Vases 2,226 ft., McClosky 2,364 ft.

Marion County: Engle and Nash Redwine 1 O. A. James, NE NW NW 22-2n-3e, dry at 2,719 ft., Lower Kincaid 1,642 ft., Cypress 2,280 ft., Benoist sand 2,430 ft., Aux Vases 2,498 ft., McClosky 2,649 ft., St. Louis 2,665 ft.

Skelly Oil 1 E. W. Jacobs, NE NW NW 31-3n-3e, dry at 2,435 ft. Lower Kincaid 1,294 ft., Cypress 2,014 ft., Benoist 2,142 ft., Aux Vases 2,198 ft., McClosky 2,356 ft., St. Louis 2,424 ft.

White County: Pittsburgh and Fairmont Coal 1 M. Land, NW NW SE 25-5s-9e, dry at 3,162 ft. Lower Kincaid 2,026 ft., Barlow 2,710 ft., Cypress 2,727 ft., Benoist 2,922 ft., Aux Vases 3,008 ft., McClosky 3,152 ft.

OHIO, KENTUCKY

Columbiana Gas Pool Extended by Oriskany Well

COLUMBUS.—East Ohio Gas Co. 1 W. J. West, Section 6, extends the Columbiana gas pool into Butler Township. Oriskany sand gaged 2,514,000 cu. ft. natural and was shut in after shot at 2,626,000 cu. ft. Two other good wells helped extend the pool in a northeast direction. Upham et al 1 J. J. Smith, Section 1, Knox Township, gaged 1,247,000 cu. ft. when shut in after shot. Sand was at 3,528-45 ft. Ohio Oil Co. 1 Fred Schoeni, Section 11, Knox Township, gaged 1,565,000 natural and was shut in at 2,015,000 cu. ft.

E. P. Mellon 3 Esther Booth, the third Oriskany well in the new Gilmore pool in Washington Township, Tuscarawas County, had only 9 ft. of sand and 155,000 cu. ft. gas. The well was a north extension and the company has located the next well southwest of the discovery.

Sixteen locations were reported with six in the Cambridge field. Ashland-Lorain field led in completions with eight.

EASTERN KENTUCKY ACTIVITIES

ASHLAND.—Two gas well completions were recorded during the week in the eastern Kentucky field, during a period which has seen an unsettled strike of United Fuel Gas Co. workers (CIO), affecting supply in a seven-state area.

Kentucky-West Virginia Gas Co. completed 5606 T. A. Davis in Knott County, at 3,099 ft., with a daily open flow of 140,000 cu. ft. of gas from shale after shot.

Inland Gas Corp. completed 278 J. H. Hammonds, Magoffin County, on Bull Creek of Licking River, at 1,042 ft., with a daily open flow of 412,000 cu. ft. from salt sand.

WESTERN KENTUCKY

OWENSBORO.—Five oil wells averaging about 52 bbl. initially and three dry holes were completed in western Kentucky in the past week. Two wildcats found oil and two others were dry.

SUCCESSFUL WESTERN KENTUCKY WILDCATS

Henderson County: Cherry & Kidd 1 Lee Eakins, NE co. 4-N-24, a Robards outpost, O'Hara lime 2,474-78 ft., acidized, TD 2,610 ft., IP 17 bbl.

Crittenden County: Joe Reznik et al 1 M. L. Woodall, 7-K-20, 11 mi. NE of Marion, Cypress sand at 1,383-97 ft., TD, IP about 30 bbl. Discovery well.

WESTERN KENTUCKY WILDCAT FAILURES

Leslie County: Sun Oil 1 Black Star Coal Corp., 1¼ mi. E of Hyden, dry at 2,767 ft., penetrating St. Peter (Wilcox) sand.

Union County: Texas 2 Culver Heirs, 11-P-20, dry at 2,732 ft. McClosky lime at 2,518-31 ft.

KANSAS

McPherson Gets 12 Bbl. Per Hour Discovery Well

NORTHWESTERN McPherson County seems assured of a new oil pool in the Sharon Drilling Co. 1 Crowther "A", NW SW NW 24-18-1w. The well had a 1,200-ft. fillup in 1 hour from the Mississippi chert at 2,829-33 ft., with the fillup later increasing to 2,600 ft. natural. Tubing was run to test, and operatbrs pumped 12½ bbl. of oil per hour natural. Total depth of the hole is 2,834 ft., with 5-in. casing set at 2,829 ft.

Pawnee County's discovery, Huber Oil Co. 1 Katchelman, NW NW SW 34-22-16w, is continuing to test. After acid, operators swabbed 28 bbl. oil in 6 hours, and later pumped 55 bbl. of oil with no water in 12 hours. Topeka was topped at 3,157 ft., Heebner at 3,507 ft., Lansing at 3,638 ft., conglomerate at 4,000 ft., Simpson at 4,047 ft., and Arbuckle at 4,059 ft. Production is coming from the Arbuckle and 5-in. pipe is set to the top of the formation.

Ed Adair 1 Roberts, SE SE SE 14-21-12w, a wildcat in Stafford County, is drilling deeper after pumping 3 bbl. oil plus 38 bbl. water, after acidizing with 500 gallons. Viola was topped at 3,533 ft., and Arbuckle at 3,600 ft. After setting pipe at 3,603 ft., and drilling to total depth 3,611 ft., 400 ft. of fluid rose in the hole in 12 hours. Operators then acidized and pumped 3 bbl. oil.

Nineteen oil wells were completed this

(Continued on page 359)

Correction

In the issues of September 8 and 15 the Oklahoma price of 26-70 natural gasoline was given incorrectly as 3.875 cents. In each case the price should have been 4.5 cents.

PENBERTHY
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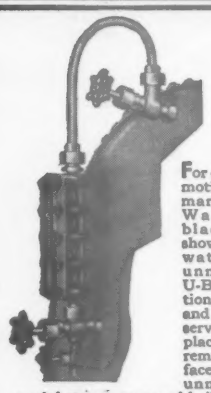
WATER GAGE SET



For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

EIGHT interchangeable cutters. Fast cutting action, directed at 30 degree angle, cutters are hard surfaced steel. See Composite Catalog or write for Bulletin and additional information.

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Among the Drilling Contractors

Barnes & Shadrick, California drilling contractor, has been awarded contract by J. H. Maurer and A. C. Fisher to drill another well on the Jean property at North Mount Poso in Kern County, California, 15-26s-28e, and an early spud will be made.

Penrod Drilling Co. has the contract to drill the Hunt Oil Co. 1 M. B. Nicholson, in C NW NW 27-13n-9w, Issaquena County, Mississippi.

Walter Slusser has the drilling contract on the Alpine Oil & Royalty Co. 1 Baxter, wildcat in NE NW SW 30-19-4e, Marion County, Kansas, and was moving in material. It will be a cable-tool test.

R-W Drilling Co. is contractor on the J. C. Reynolds et al 1 G. W. Heiby, in SE SW 26-23n-15e, Jay County, Indiana.

R. L. Fisher has a drilling contract with Congressman Boykin, of Alabama, for a test on his land near Calvert, north of Mobile, Ala.

Northern Development Co., Edmonton, Alta., has completed a gasser for North Peace Syndicate of Peace River in 36-50-3w4, in the Kitscoty area northwest of Lloydminster.

Garner Drilling Co. has been awarded drilling contract on the Central States Oil Corp. 2 Walter T. Allen, in SW NE 19-6s-13w, Posey County, Indiana. Contractor will also drill the 3 Earl Blackburn, in NE SE 19-6s-13w, for the same company.

Cook Drilling Co. is drilling a wildcat test in Bolivar County, Mississippi, for O. W. Killam, of Laredo, Tex. Location is on the Dattle plantation in NE¼ 18-23-7, about 4 miles east of Rosedale.

C. B. Jetter is the contractor for Jetter & deKrafft 1 Strong & Overdorf, SW SE SW 18-15n-6w, a Sherman pool location in Isabella County, Michigan.

V. R. Bachelor, of Rockport, Ind., is contractor on the Fred J. Pfunder & Associates 4 Bertha H. Biggerstaff, in SW SE 6-7s-7w, Spencer County, Indiana.

Valley Oil Operators, drilling contractors, of Calgary, Alta., have reached the Madison limestone high at 6,437 ft. in Mercury-Mill City 1, LSD 10, 16-18-2w5, for which they have the contract.

Dunlap & Graham were recently awarded a drilling contract to drill a deep well to the Stevens sand of Miocene age for Standard Oil Co. of California, in the Elk Hills field of California.

Kiowa Drilling Co. and J. M. Huber Corp. have taken a farmout from Stanolind Oil & Gas Co. on the southeast quarter section of 18-21-19w, Pawnee County, Kansas, and have staked location for a test. Location is the 1 Floto, which is 5 miles northeast of the town of Burdett.

Alberta Drilling & Development Co. of Calgary, Alta., is resuming from 920 ft. on Alliance 1, LSD 15, 19-20-1w4, in the Antelope Hills, eastern Alberta. The company has contract to complete the well for Trans-Alberta Oils, with Devonian limestone at 3,500 ft. as the objective.

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COLLAR
...for Wells' Stubby
ELECTRODE HOLDER

- Makes rod-changing *easier* and *quicker*, because it provides a positive, convenient grip on the insulator.
- Holds small rods upright and away from work.

See your local distributor.

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MODEL 3H
300 Amp.

BESTOLIFE LEAD SEAL
TOOL JOINTS AND CASINGS
THREAD AND GASKET COMPOUND
WORTH WAITING FOR
BUT NO WAITING
IS NECESSARY
'BESTOLIFE — the Lead Seal Joint Compound used successfully in the Drilling and Refining Industries for years — is immediately available through more than 100 distributors in the U.S.A. Any priority rating will do.
Your nearest supply house field store probably has 'BESTOLIFE in stock for immediate delivery. Use 'BESTOLIFE — it's BETTER!
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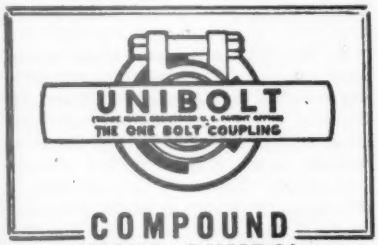
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COMPOUND YOUR PUMPS
. . the convenient, economical way. Install UNIBOLT "BIG INCH" COUPLINGS with Blanking Plugs on your pump suctions.
THORNHILL-CRAVER COMPANY—HOUSTON

MARKET QUOTATIONS

Prices as of September 18, 1945

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon.)

REFINERY GASOLINE

Octane (A.S.T.M.)	75†	70-74
Mid-Continent*	6.75	6.000
Gulf Coast	6.75	5.750
Northeast Coast	...	9.875
California	...	6.50-7.00

*Basic Oklahoma Group 3. †1939 C.F.R (research method).

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	4.500	5.400
North Texas (f.o.b. plant)	3.500	4.200
North Louisiana (f.o.b. plant)	3.750	4.500
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl	
East Texas	$1.23
Conroe	1.49
Tepetate, Louisiana, avg. grav.	1.20
Illinois Basin	1.37
Pecos County, Texas	.95
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.09

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma Kansas	Gulf Coast Texas	West Tex.*
18-18.9	$0.80	....	....	...
19-19.9	.84	....	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.09	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.12

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended September 8, 1945

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks — Gasoline	Distillate	Residual
East Coast	734	15,270	13,391	8,668
Appalachian	149	3,711	1,013	508
Ill., Ind., Ky.	777	17,448	6,204	3,193
Okla., Kan., Mo.	389	7,449	2,583	1,377
Inland Texas	227	2,571	468	1,044
Tex. Gulf Coast	1,073	16,838	5,120	5,642
La. Gulf Coast	266	4,026	1,859	1,106
North La., Ark.	87	2,813	568	220
Rocky Mt.	127	1,894	465	722
California	811	13,210	10,518	25,391
Total 9-8-45	4,640	*85,230	42,189	47,871
Total 9-1-45	4,685	84,218	40,859	46,807
Total 9-9-44	4,634	78,110	41,716	60,722

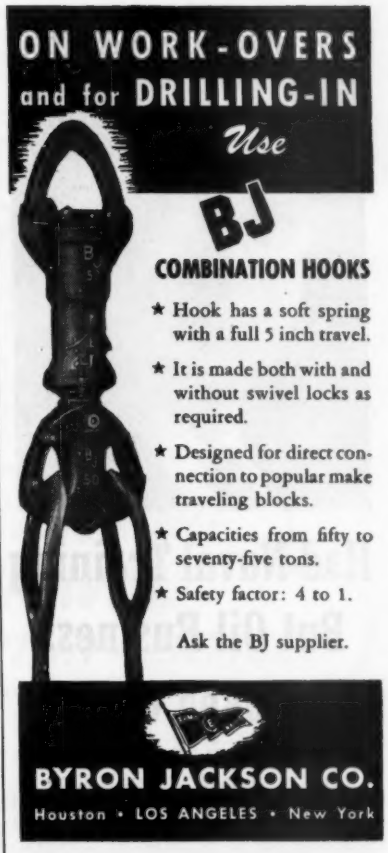
*Military 36,118. Civilian 49,112.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
September 8, 1945	213,721,000
September 1, 1945	†215,169,000
September 9, 1944	220,623,000

*Excludes unrefinable California stocks. †Revised.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and for DRILLING-IN
Use
BJ
COMBINATION HOOKS
★ Hook has a soft spring with a full 5 inch travel.
★ It is made both with and without swivel locks as required.
★ Designed for direct connection to popular make traveling blocks.
★ Capacities from fifty to seventy-five tons.
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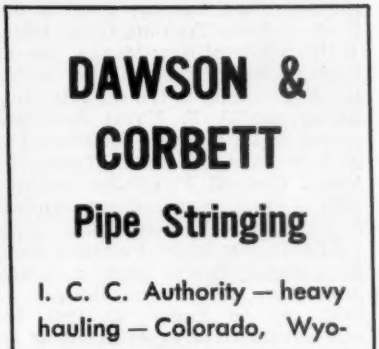
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I. C. C. Authority — heavy hauling — Colorado, Wyoming, Montana, North and South Dakota. Pipe lining — building & construction — derrick skidding. Trucks — tractors — trenchers and welders.
Baroid products in stock at Riverton and Rawlins, Wyoming, and Craig, Colorado.
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PERSONALS

Had Naval Training But Oil Business Looked Good

ALTHOUGH B. H. Robinson, recently named general superintendent of production for General Petroleum Corp., had received 4 years of naval training at Annapolis, not to mention his work in the Student Army Training Corps while at University of New Mexico, the oil business looked good to him. So instead of turning to the sea after finishing the U. S. Naval Academy course in 1922, he got a clerical job with Sinclair Oil Co. in Tulsa. He joined General Petroleum in July 1925 as timekeeper in the accounting department at Vernon, Calif.

After filling several clerical positions Robinson was made assistant production engineer on January 1, 1930, and on August 15, 1941, he was advanced to superintendent of the southern division of the production department. Promotions continued until he was appointed to his present post.

Robinson is a former national chairman of the production committee and of the drilling committee, American Petroleum Insitute. In 1941-42 he was elected chairman of the institute's Pacific Coast district, division of production. His hobby is color photography and he is a member of Los Angeles Camera Club.

Carl A. Harris, formerly general superintendent of the Burnham, Ill., refinery of Calumet Refining Co., has been promoted to general manager of the company. He takes the place of **A. J. Smith,** who resigned recently. Harris joined Calumet 22 years ago.

Sgt. Nicholas Oresko, winner of the Congressional Medal of Honor, was welcomed at the Standard Oil Co. of New Jersey Bayway refinery gates by 100 World War II veterans who are already back on the job in the refinery. Later he is to be honored at a directors luncheon.

William G. Heinze, engineer of PAW's conversion section, distribution and marketing division, has left the District 1 offices to become associated with the Centre Heating & Supply Co. of White Plains, N. Y.

Martin Egan, who was on a special geological assignment in Venezuela for The Atlantic Refining Co., has resigned and returned to Mt. Carmel, Ill., to enter consultant work.

Abbott H. Cole, petroleum facilities specialist of the facility securities division, has left PAW to rejoin the Socony-Vacuum Oil Co., Inc.

M. G. GAMBLE

M. G. Gamble has been appointed general manager of the marine department of Standard Oil Co. (New Jersey), succeeding **B. B. Howard,** recently elected to the board of directors. As assistant general manager during the war, Gamble coordinated operations of the ESSO tanker fleet while under requisition to War Shipping Administration. **John J. Winterbottom,** manager of the marine traffic division, but now on leave with WSA, has been named an assistant general manager.

Raymond B. Hooper, transportation analyst, has left PAW and has been named traffic manager of Cities Service Oil Co.

C. Walter Frankenfield has been appointed supervisor of Tide Water Associated Oil Co.'s automotive laboratory at its Bayonne, N. J., refinery, replacing **Leonard Raymond,** who resigned.

Charles S. Sichel, analyst of PAW's distribution and marketing division, has left the agency to join Metropolitan Oil Co. as manager of the plant at Mount Vernon, N. Y.

James W. Cowles has been appointed manager of the natural-gas and natural-gasoline division of Shell Oil Co., Inc., at Tulsa. He succeeds **B. R. Carney,** who resigned. Cowles has been in the employ of Shell's natural-gasoline division 21 years. Trained as a lawyer, he spent years in the Department of the Interior with the Five Civilized Tribes as an authority on legal matters and leasing contracts in Oklahoma. Later he was with Oklahoma Petroleum & Gasoline Co., then Skelly Oil Co., before joining Shell. In 1938 he received the Hanlon Award for meritorious service to the natural-gasoline industry in the simplification of gas contacts.

James W. Cowles

J. W. Connolly has been made head of the newly formed marketing council department of Standard Oil Co. (N. J.) and appointed vice chairman of the Marketing Council, central sales group of the Jersey companies. The new department is an advisory group reporting directly to the directors of the parent company.

John Desisto, formerly surface geologist in Tulsa for Sinclair Prairie Oil Co., has been assigned to Caracas, Venezuela, as assistant to **John Mallar,** on the staff of the Venezuelan Petroleum Co., Sinclair Prairie affiliate.

A. N. Griffith has resigned as production superintendent for Lario Oil & Gas Co. and its affiliate, Globe Oil & Refining Co., in Midland, Tex., to join Hunt Oil Co. and its subsidiary, Penrod Drilling Co., as production and drilling superintendent. His headquarters will remain in Midland.

Elbert Ford, civil engineer, for the past 16 months in Baton Rouge with the Louisiana division, Standard Oil Co. of New Jersey, has been assigned to a post in Caracas, Venezuela, with Creole Petroleum Corp., a

New Jersey Standard affiliate. The group with which he will be associated is charged with mapping areas in Venezuelan jungles heretofore unexplored.

Lt. Col. R. Dwight Funk, proration engineer for Cities Service Oil Co., Bartlesville, Okla., before entering war service, has been awarded the Silver Star for heroic achievement in Sicily. Under continuous fire he directed his own battalion in silencing an enemy position.

C. A. Urice, formerly in the drilling department of Barnsdall Oil Co. and operating in Oklahoma, has been made superintendent of J. R. Sharp Drilling Co., with headquarters in Midland, Tex.

M. E. Foster, Bartlesville, Okla., manager of the supply and transportation department of Phillips Petroleum Co., won first place in the all-around archery event at the Southern Archers' tournament in New Orleans. He and **Mrs. Foster,** competing against 65 entrants from 14 states, won three first places, three seconds, and three thirds in the individual events. Paired with **Mr.** and **Mrs. D. V. Gourley,** they carried Oklahoma's colors to first place in the team event. Gourley is in the accounting department of Helmerich & Payne, Tulsa oil producers. Gourley won the flight event, shooting an arrow 435 yards, and Mrs. Gourley was second in the women's target events. Mrs. Foster was first in the women's field event, third in the clout and field events, and was the second-best all-around woman archer.

W. G. Elicker has been elected secretary of The Texas Co. He had been assistant secretary 16 years. Elicker graduated from Pennsylvania State Teachers College in 1908 and resigned in 1918 as principal of a grade school in Roselle Park, N. J., to take a position with Texas in the accounting division of the marine department. In 1928 he was transferred to the secretary's office and the next year was appointed assistant secretary.

Phillip S. Magruder has been elected to the board of directors and appointed manager of the manufacturing department of General Petroleum Corp., Los Angeles. He succeeds Raymond C. Wheeler who died last month. Magruder joined General Petroleum in 1925 after more than 8 years with Gulf Oil Corp. and Texas Pacific Coal & Oil Co. He rose to general superintendent and in 1942 manager of the gas department. In May 1945 he was made assistant manager of manufacturing.

Walter F. Pound has resigned as state geologist in Tennessee and has been succeeded by **H. P. Burwell,** formerly his assistant. **W. H. Lockwood,** Tennessee's assistant state geologist, has resigned also.

John M. Pierce, economist and tax consultant, has joined the staff of Western Oil and Gas Association, Los Angeles. He is a graduate of University of California and the Graduate School of Business Administration of Harvard University.

CALENDAR

October

American Association of Oil Well Drilling Contractors, Oklahoma City, October 1-2.

I.P.A.A., annual membership meeting, Tulsa, October 15, 16 and 17.

American Gas Association, annual meeting, Engineering Societies Building, New York, October 24-25.

November

American Petroleum Institute, annual meeting, Stevens Hotel, Chicago, November 12-15.

1946

April

Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas, April 17-19.

THIS HOT OIL PACKING CAN'T UNRAVEL OR COME APART IN SERVICE!

ARE YOU LOOKING for a rod packing that will really stand up in hot oil service?

Try J-M No. 270 Interlocked—the rod and plunger packing that can't unravel or come apart because it has no jackets to wear through, no plaits to become loose. The asbestos yarns used in its construction are actually *interlocked* to form a solid, integral structure!

And another feature that means better performance—it is braided square to provide a tight seal with minimum gland pressure.

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Equipment Men in News

H. H. Harris, manager of the Process Machinery Division of Enterprise Engine & Foundry Co., San Francisco, Calif., announces appointment of **H. J. McPeak** as sales engineer in charge of Process Machinery Division sales.

The appointment of **Henry A. Bourne** as sales manager for Republic Steel Corp. in the Tulsa district is announced by **J. M. Schlendorf,** vice president in charge of sales. Bourne joined Republic in 1943 as a salesman in the Tulsa district. Prior to that, he was district sales manager in Houston for the A. O. Smith Corp. in Milwaukee. He succeeds the late Hoyle Jones.

Lester N. Harrison has been named Southeastern district manager of the Votator division of The Girdler Corp., Louisville, Ky., with headquarters in the Johnston Building, Charlotte, N. C. His appointment was announced by **John E. Slaughter, Jr.,** vice president in charge of the Votator division.

Fernal R. Marlier, president of the Portable Products Corp., has announced the appointment of **E. D. Wacker** as general manager of its C. J. Tagliabue Division, Brooklyn, N. Y. Wacker for the last 8 years has been general sales manager, and associated with C. J. Tagliabue for a period of 22 years.

Paul Charrin, who recently left Schlumberger Well Surveying Corp., of which he had been vice president for many years, and opened a private office as consulting engineer and geophysicist, has been elected president of Universal Exploration Co., of Houston, Tex. However, he will retain his consulting office at 913 Union National Bank Building. **Darrell Williams,** former president of Universal, remains as a director.

Appointment of **Hunter Nicholson** as Los Angeles factory manager of Kelite Products, Inc., was announced recently by **L. C. Sorensen,** president and general manager.

W. M. Garney, of Houston Oil Field Material Co., Inc., has been appointed business manager of Arizona Barite Co., and will move to Phoenix, Ariz., shortly to assume his new duties. There he will work with **W. F. Paine,** who is production manager for this new company. **George Skipper** succeeds Garney as chief clerk of the sales department. He will also work directly with the tubular goods department. **W. B. Stallings** has been appointed manager of the tubular goods sales and, with Skipper, will handle all matters pertaining to sales of oil-country pipe. **Otho Meadows** has been transferred from field sales work at Odessa, Tex., to Harvey, La., where he has assumed his new duties as store manager. **J. B. Porterfield** has been placed in charge of mud and chemical sales in the Odessa district, working in conjunction with **L. L. Talley,** district sales manager. The Magnolia branch of the cutting and fishing-tool department, under **E. P. Sawyer,** is being transferred to Shreveport, La. The company also announces the appointment of **Leslie P. Graff** as district engineer in South Texas. He will assist Homco's branch stores and their customers in that area with their drilling and production equipment problems. He has been engaged in this type of work since graduating from Rice Institute in 1932. Graff will reside in Alice, Tex., although his headquarters will be in Corpus Christi, Tex.

LESLIE GRAFF

E. LIEBER

J. C. BRITTON

Dr. Eugene Lieber has joined Nox-Rust Chemical Corp. as technical director of manufacturing activities. Involved will be rust preventives, petroleum additives, industrial lubricants and related products. He will make his headquarters in the laboratory at 2461 Halsted St., Chicago. Dr. Lieber comes from the Standard Oil Co. of New Jersey, where he was chemical director of the para-plant of the Bayonne, N. J. refinery.

Lt. Col. Joseph C. Britton, in charge of pipe-line construction for the Army in the Far East for the past several years, has returned to assume active supervision of work handled by Eastern Construction Co. **C. Hobson Dunn,** outstanding in pipe lining for over 20 years, has joined Britton as partner.

Tweco Products Co., Wichita, Kans., has concluded arrangements with Henry R. Jahn & Son Co., 7 Water Street, New York, for the sale of the complete Tweco Products line. Jahn will have world coverage with the exception of the United States, Alaska, the Hawaiian Islands, and Canada.

Paul F. Kohlhaas has been appointed to fill the newly created position of vice president in charge of engineering of Columbia Steel Co., San Francisco, Calif. Kohlhaas has been since 1941 chief engineer of the company, a subsidiary of United States Steel Corp.

An export sales department has been established by Beech Aircraft Corp. to be headed by **E. S. Safford. W. Homer Kelly** has been named public relations director, a position which includes the direction of the firm's advertising.

Sigfried A. Olson, Jr., has been named industrial manager at Stockholm, Sweden, for Brown Instrument Co., Philadelphia division of Minneapolis-Honeywell Regulator Co. Olson has been New York sales engineer for the Brown company for the past 9 years.

McGowan Pump Division of Leyman Manufacturing Corp., Cincinnati, Ohio, announces the opening of offices at 342 Madison Avenue, New York. This office will be managed by **J. Arthur Moore.**

Chiksan Co., Brea, Calif., announces the appointment of Well Equipment Manufacturing Corp., Houston, Tex., as exclusive Chiksan representative for Texas, Oklahoma, and Kansas, and portions of Mississippi, Arkansas, and New Mexico.

Construction of a new test laboratory to cost $750,000 and greatly extending the facilities of the research engineering division of the Elliott Co., Jeannette, Pa., is announced by **Grant B. Shipley,** president. Plans for extensive research and development on gas turbine power plants have called for the construction of a new main building, 60 by 140 ft., and several small buildings separate and adjacent to it. Construction has already been started and is expected to be completed within 6 months. Located adjacent to the main Elliott factory at Jeannette, Pa., the new laboratory will be of windowless construction with uniform fluorescent lighting in addition to localized flood lights.

Exclusive rights to the Pulsafeeder Chemical Proportioning Pump, for continuous precision blending of fluids, introduced 6 years ago and since marketed by Wilson Chemical Feeders, Inc., of Buffalo, N. Y., have been purchased by Lapp Insulator Co., Inc., of LeRoy, N. Y. **Lawrence F. Wilson,** who invented and developed the Pulsafeeder, **Victor H. Leipold,** service engineer, and other Wilson personnel have become affiliated with Lapp and will continue in responsibility for Pulsafeeder engineering, manufacture, sales and service.

The A. P. Green Fire Brick Co. has moved its advertising and public relations department from its general offices and plant at Mexico, Mo., to St. Louis, with offices in the Railway Exchange Building. All company advertising is now being handled from that office.

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